August 1966

Agriculture

Vol. 73 No. 8

SELECTED CONTENTS

Estimating Cereal Yields . . . . . *A. H. J. Baines*
Mechanization of Vegetable Production . . . . . *T. Laflin*
Coxes at Fernhurst (2) . *R. O. Cobham: J. F. Crozier: G. D. Lockie*

PIGS FEATURE
Farrowing to Fattening Houses . . . . . *C. Dobson*
Problems in Pig Feeding . . . . . *R. Braude*

Rabbit Control by Cyanide Gassing *H. V. Thompson: R. H. Thompson*
Fattening Store Lambs on Hill Farms . *G. L. Williams: R. Andrews*
Erosion Control on the Black Fens . . . . *N. J. Sneesby*

Published for the Ministry of Agriculture, Fisheries and Food by Her Majesty's Stationery Office

1s. 3d.
MONTHLY

AT LAST—

LIGHTWEIGHT PACKAGE DEAL UNITS FOR FARM BUILDINGS

Specialist designed buildings for Cows, Beef Cattle and Sheep. Packed as a complete KIT and delivered to the Farm.

- ★ **Easily erected by farm or estate labour (no cranes)**
- ★ **Detailed erection plans**
- ★ **Precision made lightweight steel frames and cladding**
- ★ **Supplied in 12ft. multiples**
- ★ **Suitable for mechanised feeding**
- ★ **From only £24 per animal (delivered)**
- ★ **Available throughout the world—FREE delivery in England, Scotland and Wales.**

Farmpak reduces costs by the use of standard units and simplicity of construction means that we are able to provide, at the lowest all-in cost ever, top quality farm buildings COMPLETE, including roof and vertical cladding, cubicle divisions, mangers and gates.

Farmpak Lightweight Buildings Ltd.
Wide Lane, Swaythling,
Southampton, Hants.

Please send free details and brochure: *Tel. 54605*

Name.....

Address .....

Telephone.....

Type of building required (state uses):

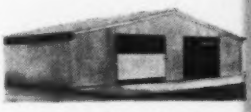
.....

.....A.4.F.

FarmPak

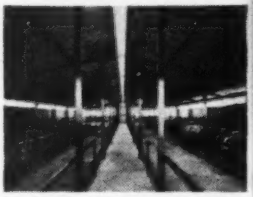
a member of the HILL group of companies

A TYPE FOR YOUR SYSTEM



Choice of 5 cubicle houses

Interior of Type 'C' with manger



Building for cattle suitable for large feeding lots for only £28 per animal

Stamp out couch ! with WEEDAZOL

✱ For full details and names of main distributors apply to the manufacturers:-

A. H. MARKS & CO. LTD.
WYKE, BRADFORD
Phone: Bradford 76372/3

Marks

AGRICULTURAL CHEMICALS APPROVAL SCHEME

1 TAS/MK67A

This little pig went to market

...but it could have gone 2 weeks earlier and saved over 50-lbs of meal!

This is the measure of the increased fattening rate which can sometimes be effected by the inclusion of up to 2-lbs Copper Sulphate per ton of meal in the diet of fattening pigs.

COPPER SULPHATE

the ally of Agriculture

For details of this and other uses of Copper Sulphate write to:

McKECHNIE CHEMICALS LIMITED, P.O. BOX 4, DITTON ROAD, WIDNES, LANCS.
TELEPHONE: WIDNES 2611 TELEX 62171

Agriculture

VOLUME 73 · NUMBER 8 · AUGUST 1966

Editorial Offices
Ministry of Agriculture, Fisheries and Food
Whitehall Place, London S.W.1. Trafalgar 7711

CONTENTS

Straw and Stubble Burning 351
Estimating Cereal Yields *A. H. J. Baines* 352
Mechanization of Vegetable Production *T. Laflin* 357
Coxes at Fernhurst (2) *R. O. Cobham, J. F. Crozier* and *G. D. Lockie* 361
Double Gloucester Cheese *Kathleen Maddever* 368

PIGS FEATURE

Farrowing to Fattening Houses *C. Dobson* 372
Problems in Pig Feeding *R. Braude* 377

Taxation and Capital—Introduction to a Series *A. J. Davies* and *H. A. Thomas* 382
Rabbit Control by Cyanide Gassing *Harry V. Thompson* and *R. H. Thompson* 383
Fattening Store Lambs on Hill Farms *G. L. Williams* and *R. Andrews* 387
Erosion Control on the Black Fens *N. J. Sneesby* 391
Ministry's Publications 394
Farming Cameo Series 3: 43. Woodbridge, East Suffolk *G. R. Field* 395
From the ALS: The Maintenance Survey *W. A. Vandersteen* . . 397
Book Reviews 399

© *Crown copyright 1966*

Provided that the source is acknowledged in each instance such articles and notes as are published in this Journal without any specific reservation regarding copyright may be reproduced in any registered newspaper or public periodical without special permission. The Ministry does not accept responsibility for statements made, or views expressed, in signed contributions to this Journal or in those reproduced from another source.

Further, the Ministry does not accept responsibility for any of the private and trade advertisements included in this publication.

In the interests of factual reporting, occasional reference in this Journal to trade names and proprietary products may be inevitable. No endorsement of named products is intended, nor is any criticism implied of similar products which are not mentioned.

All communications respecting advertising in the Journal should be addressed to the Advertisement Contractors, Cowlishaw and Lawrence (Advertising) Ltd., Memorial Hall Buildings, 16 Farringdon Street, London E.C.4. Telephone: City 3718.

SILCOCKS PIG FOODS

"congratulations"

Use two of the remarkable new Silcock foods to produce porkers, and enjoy unprecedented profits—GROWER from weaning to 70 lb. liveweight and "ELITE" thence to slaughter. Not only will the cost per lb. liveweight gain be the lowest ever, but the pigs will also show substantial earnings in higher killing-out percentage. This is what Mr. J. Tinsley, Managing Director of Pork Traders (Liverpool) Ltd., has to say about it:

"A consignment of porkers raised on your new foods came into the factory yesterday. They averaged 138 lb. liveweight and showed an average killing-out percentage of 77.9 (as compared with around 71.2% which is normal for that weight). The producer therefore received payment of an extra 22/- for an additional 9¼ lb of carcase per pig! I might add that the quality of this consignment was one of the highest we have ever seen. Obviously, the new Silcock foods have had a great deal to do with this, and we send our congratulations!"

Have a word with your Silcock Agent NOW or write direct to Liverpool.

SILCOCKS

R. Silcock & Sons Ltd.,
Stanley Hall, Liverpool 3.

Straw and Stubble Burning

WHEN in August last year we drew attention to the Safety Code for Straw and Stubble Burning just published by the N.F.U., we had little inkling that the harvest was going to be as wet and difficult as it turned out to be. At the time of writing this article we can do no more than to hope that last year's sorry experience is not going to be repeated. But much as last year's bad weather was to be deplored, it did at least help to keep down damage caused by the burning of straw and stubble. The N.F.U. took the initiative in introducing their Safety Code, after consultation with a large number of organizations including Government Departments, following the wide public concern at the amount of damage which was done during the dry summer of 1964 through straw and stubble fires getting out of control. Although last year was not a fair trial, there were welcome signs that the lessons of the Code were being taken to heart. The increase in the cereal acreage makes it even more important that those farmers who choose burning-off as the only way of disposing of surplus straw and clearing their stubbles should take the greatest care to ensure that the operation is conducted without danger to life and property and inconvenience and anxiety to other members of the public. It is foolish to take unnecessary risks, and it is to be hoped that the very sensible precautions in the Code will be studied and applied during the coming harvest period. It is sad to record that even last year there was one tragic accident involving a small child. Farmers are asked to keep a particular watch for children who might be attracted to the scene when burning takes place.

Estimating Cereal Yields

A. H. J. Baines

SINCE the Second World War, and especially during the past decade, cereal yields have increased rapidly because of improved varieties and other technological improvements. Yields still vary widely from year to year because of the weather, but we have come to expect a new record every second or third year. In preceding generations, when yields varied about a mean which remained much the same for a working lifetime, the estimation of yield simply involved assessing the deviation of conditions from that mean. Deviations now have to be measured not from a level yield but from a steeply ascending trend line. The Ministry and the industries which it serves need to take into account all the available evidence, and this article indicates the present sources of information, the problems involved in reconciling them and the prospects of improvement.

Collection of data

The Ministry prepares provisional estimates of yield per acre for the main cereal crops month by month from the end of July, as harvesting proceeds.

The first two preliminary figures are based on the estimated yields for counties, the next two (for September and October) on those for N.A.A.S. districts; these are weighted according to the corresponding June census acreages to give yields for England and Wales. The system thus uses the local experience of technical officers who make or obtain estimates of yield per acre for their own districts.

By mid-November the harvest has been completed, and firm estimates of yield and production are required; they are not necessarily final, but they are meant to be published county by county. District Agricultural Advisers provide estimates of yield for one-third of the parishes in each district; if necessary, supplementary parishes are added to give a more representative sample. These parish estimates, based on the D.A.A.'s own assessment after consultation with cereal growers, are scrutinized and approved by the County Agricultural Advisers, who forward them with their comments to the Agricultural Census Branch at Guildford. There the yield for each parish is weighted by the acreage of the crop returned for that parish at 4th June to estimate the yields per acre for each county and for England and Wales.

Some subsidiary points of definition may be mentioned. If in any of the listed parishes a crop is known to have failed, the June acreage is reduced accordingly; if it came to maturity and was lost or mainly lost because of adverse weather conditions at harvesting, the acreage is not reduced, but the reporting officer takes into account a low or zero yield for part of his area in preparing his estimates for the whole of the area. Thus the estimated yield represents the total harvested production (including unsound grain and tail corn) divided by the total acreage which came to maturity. In wet seasons the D.A.A.s make allowances to bring yield estimates down to a normal moisture content—18 per cent for wheat and oats and 16 per cent for barley. For grain in stacks or ricks, the estimated yield relates to the amount, at adjusted moisture content, which it is expected will eventually be threshed.

Problems of estimation

This method of estimation is necessarily subjective, but personal bias is minimized by the number of reporting officers (339 in 1965). They do not, however, rely solely on their own observation but seek additional evidence from farmers. This is particularly important having regard to the increased use of bulk handling, even when the grain is stored in bins of known dimensions, and all the more so when floor storage is utilized. Some countries, but not the United Kingdom, base their yield estimates mainly or exclusively on crop surveys involving crop-cutting. If this method is applied to growing crops, it gives estimates of the biological yield, which is not fully realizable in actual harvesting. To obtain final yields, test cuttings and weighings are undertaken just before harvesting, when biological maturity has been completed, and parallel experiments on harvesting losses are also needed. In countries like England and Wales, moreover, local conditions are so variable that a fully representative crop-cutting survey would be extremely costly and time-consuming.

One reason for seeking additional evidence is that the preliminary estimates, up to 1st November, whether taken on a district or a county basis, are almost always lower than the mid-November figures. The increase in yield estimates which normally occurs between 1st and 15th November is not quite regular

enough to be predictable; it may arise from the difficulty of giving adequate weight at the earlier dates to parishes with high yields when the D.A.A.s are reporting on a wider area, not on individual parishes. It may be asked whether there would be a further rise in the 15th November estimates if D.A.A.s were asked to report on a representative sample of farms instead of parishes. To test this point, an experimental survey based on individual holdings was carried out in 1956 and 1957; it gave results very close to those obtained by the parish method.

The Cereal Stocks Survey

A check on the official yields obtained by the method described above is provided for wheat, barley and oats by the monthly Cereal Stocks Survey, which is based on postal returns from a sample of some 2,800 holdings (2,000 to 2,500 before 1964) chosen so as to be representative of all types of cereal growers. The sampling fractions take into account the cereal acreages on the holding. As its name implies, the Cereal Stocks Survey is primarily intended to assess the stock position from month to month, but growers provide estimates of their production as well as of their sold and unsold stocks at the end of each month from October to June, and from these figures alternative estimates of yield can be derived. There is provision for growers to revise their first (end-October) production figures, but most of them adhere to their original statements. Consideration is therefore being given to the possibility of conducting a similar survey on a fresh sample of holdings towards the end of the cereal year, in order to remove this potential source of bias. In the table which follows, the official estimates, based on D.A.A.s' reports, are compared with estimates based on the Cereal Stocks Survey; the end-December Survey figures have been used except where indicated. The column headed 'Cereals Deficiency Payments' is explained below. To put these figures in perspective, it may be noted that before 1948 the highest official estimate of the yield of wheat on record was 20·3 cwt per acre, of barley 19·0 cwt, and of oats 17·6 cwt.

Cereal yields—England and Wales

(cwt per acre)

	Wheat			Barley		Oats	
Year	Official estimate	Cereal Stocks Survey	Cereals Deficiency Payments	Official estimate	Cereal Stocks Survey	Official estimate	Cereal Stocks Survey
1957	25·3	25·6(*c*)	24·7	22·3	22·3(*c*)	18·7	18·1(*c*)
1958	24·5	24·5(*c*)	22·9	22·8	21·3(*c*)	19·8	19·4(*c*)
1959	28·8	28·5(*c*)	28·2	26·1	24·9(*c*)	22·6	21·6(*c*)
1960	28·4	29·4	28·9	25·0	24·6	21·4	21·7
1961	28·1	27·5	27·2	26·1	25·2	23·1	22·4
1962	32·2(*a*)	34·2	34·7	29·0	28·8	25·2	25·8
1963	31·3	31·6	30·7	28·3	28·3	24·6	25·9
1964	33·0(*b*)	33·6	33·6	29·4	28·8	26·4	27·4
Average 1957–64	29·0	29·4	28·9	26·1	25·5	22·7	22·8
1965	32·4	32·4	*n.a.*	29·9	29·9	26·6	27·9

(*a*) Subsequently amended to 34·8 cwt per acre.
(*b*) Subsequently amended to 33·7 cwt per acre.
(*c*) End-June figures.
n.a. Not yet available.

Cereals Deficiency Payments Scheme

The Cereal Stocks Survey, like the official yield estimates, makes use of information from farmers who may share a common optimism or pessimism about harvest prospects. For wheat, however, there is an objective estimate provided by the Deficiency Payments Scheme, though this is not available until the end of the cereal year. From other evidence on utilization, it is believed that about 97½ per cent of the wheat grown in England and Wales normally attracts deficiency payments. Hence if the recorded quantities are divided by the production acreage and the result multiplied by 100/97·5, an independent estimate of yield is obtained. Particular attention was first given to this source in the 1960–61 season, when it pointed to a yield of 28·9 cwt per acre, 0·5 cwt in excess of the official figure of 28·4 cwt. The latter was not, however, an impossible figure: very little of the 1960 crop was retained for seed and less than usual for feeding, and wastage may also have been less than in previous years. A clearer case arose in 1962, when C.D.P. claims indicated a yield of 34·7 cwt per acre, 2·5 cwt more than the official estimate. The latter was ultimately amended to 34·8 cwt per acre, after a review of all the evidence from each county. There was also a much smaller discrepancy in 1964. Both in 1962 and in 1964 the Cereal Stocks Survey estimate of yield was closer to the C.D.P. than to the official figure.

Comparison of the series

A scrutiny of the table reveals the probable source of the difficulty. Errors of bias are most likely to occur in a year when the actual yield is exceptionally high or exceptionally low compared with the average of recent years. In such cases there is a natural tendency for changes to be understated. In 1959, 1962 and 1964 the wheat yield was much higher than in the previous year, the average increase being 5·2 cwt per acre according to the C.D.P. claims, 4·2 cwt according to the Cereal Stocks Survey, and 3·4 cwt according to the first official estimates. In 1958, 1961 and 1963, on the other hand, the yield of wheat declined, the average decrease being 2·5 cwt per acre according to C.D.P., 1·9 cwt according to C.S.S., but only 0·7 cwt according to the unrevised official figures. For 1960 the evidence is conflicting.

For the period 1957–64 as a whole, the average change between one year and the next (irrespective of sign) was 3·4 cwt per acre according to C.D.P., 2·7 cwt according to C.S.S. and 1·8 cwt according to the unrevised official series, which thus appears to have understated the fluctuation from year to year. To a lesser extent, this also applies to the Cereal Stocks Survey.

The average wheat yield for the eight years 1957–64 is practically the same for the C.D.P. as for the unrevised official series, while the Cereal Stocks Survey gives a mean about 0·5 cwt in excess of the other two series. Assuming that the 2½ per cent adjustment for quantities not attracting deficiency payments is correct on average, the present method thus appears to have given the right level of yields for the period as a whole. Taking the C.D.P. figure as criterion, the Cereal Stocks Survey has been more nearly right for individual years, but not for the period as a whole, since it appears to have an upward bias of the order of 0·5 cwt per acre. This is almost certainly because it has to start so early in the cereal year; a later survey of the same kind should be more accurate.

For barley and oats, no comparison with the Deficiency Payments Scheme data is possible because of the very large quantities of these grains retained for stock feed, and direct evidence on the utilization of grain on farms of origin is therefore being sought. But since the yield estimates for barley and oats are obtained by exactly the same method as those for wheat, they would seem entitled to the same degree of confidence. During 1958–61 the official and the C.S.S. yields for barley diverged, the latter being on average 1 cwt lower, but since 1962 they have been in fair agreement. For oats, the C.S.S. yields were on average 1 cwt higher in 1962-65, giving a steeper trend for the whole period; there is, however, a possible break in series in 1964, when holdings growing oats but no wheat or barley were represented in the C.S.S. sample for the first time.

Even if significant errors do occur between estimates of barley yield made by the Ministry and the true figures, this does not affect the size of the deficiency payments which farmers receive provided total production of barley in any given year is above the corresponding standard quantity. That this is so is evident from a consideration of the formula used to calculate the deficiency payment: briefly, the difference between the guaranteed price per cwt and the average market price per cwt (in any cereal year) is reduced by a factor which has the 3-year average yield in cwt per acre included in the *denominator*; this reduced deficiency payment per cwt is then multiplied by another factor, which contains the same 3-year average yield in cwt per acre in its *numerator*, in order to obtain the rate of payment per acre. So, no matter how far removed from the true figure the estimated 3-year average yield happens to be, the deficiency payment per acre is not affected since the two 3-year average yield entries in the formula are self-cancelling.

Conclusion

Experienced advisory officers are still able to make good estimates of yields per acre, but technological changes have increased their difficulties and it is clearly desirable to take evidence from other sources into account. A limitation of the Cereal Stocks Survey is that although it secures greater objectivity by obtaining information directly from individual growers, it does not at present provide reliable estimates down to county level. The Ministry is therefore considering the practicability of extending this survey and also of experimenting with other supplementary methods of obtaining information directly from individual cereal growers. In continuing its efforts in this direction the Ministry fully recognizes that reliability, timeliness and efficiency in estimating yields are matters of national and international importance.

This article has been contributed by **A. H. J. Baines, M.A.**, of the Ministry's Statistics Division.

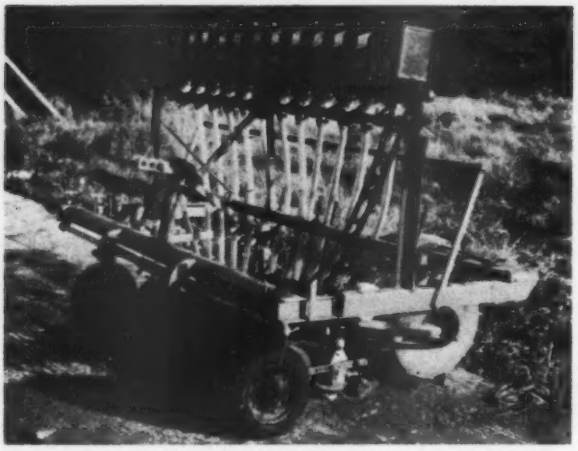
Mechanization of Vegetable Production

A method of bulk handling cauliflowers used by a grower in Lincolnshire

T. Laflin

Can we produce all our vegetables without hand-work? Probably not, but the use of machinery has already changed the pattern of production in some of our main vegetable crops and the trend is likely to increase so that hand-work is the exception rather than the rule.

There are two important factors which have contributed to the extensive mechanization of the work connected with the growing of vegetables. The first is labour, particularly the high cost and fewer numbers of experienced workers, the need to employ more people without experience of horticultural work, and the need to eliminate some of the less attractive operations. The second is the requirement for large and continuous quantities of a product which conforms to a fairly narrow specification. Differences of performance and selection between different workers or the same workers at different times can be greatly reduced where a machine can be used to do the job. Also, an operation which must be done within a short period to have the maximum effect can often be carried out within that time, whereas this could not be done by manual methods. Many machines are costly and operate for only a few weeks in each year. They can only be justified if the crop area grown is large enough to keep them in operation for the whole of their season of work and so keep the unit cost down to a reasonable level. A machine, e.g., a pea viner, a carrot grader or a celery washer, may be used for



A gang of bean seeder units modified to drill a bed of carrots consisting of twelve rows four inches apart

one crop only and the specialist grower of that crop may be the only business which can get the full benefit from the machine. Mechanization has, therefore, tended to increase both large-scale and specialized vegetable growing.

Drilling and planting

The preparation of the land for a vegetable crop is, basically, the same as for other annual crops, and the machinery used is the same, so that the complete mechanization of this part of the work of the vegetable grower is so commonplace that it no longer excites notice. Some advances in drilling and planting are more recent. Research into the effect of spacing on the characteristics and yield of crops has provided the knowledge on which we can base our plant populations to give us the highest yield of a particular size or type of vegetable. Spacing drills have been designed to place seeds at regular distances along a row, and drills of improved design will give an evenly-distributed continuous band of seeds along a row. With spaced drilling, seeding patterns have to allow for seeds which fail to germinate and field losses of seedlings. Where two feet apart in the row is the desired plant, two seeds can be dropped an inch apart every two feet. If both germinate, the poorer plant is removed more easily and cheaply than setting out and singling a continuous row, seed quantity is reduced and planting costs and checks are eliminated. Seeds of irregular shape may have to be prepared for these drills by pelleting, or smoothing the seed surface by 'rubbing', and grading may be needed to ensure the uniformity in seed size which is necessary if the drills are to operate at their best level of performance. Transplanting may be preferable to drilling where it shortens the length of time the crop uses the land over direct seeding, or allows deeper planting to increase stability or stem blanching. Improved mechanical planters are now available to handle a variety of vegetable crops over a wide range of spacings.

Weed and pest control and irrigation

Chemical weed control has reduced the cost of weeding operations in many crops, and has enabled closer spacings with some crops than were previously possible. The balance between the correct quantity of herbicide to give good weed control without crop damage is sometimes a very fine one, and a

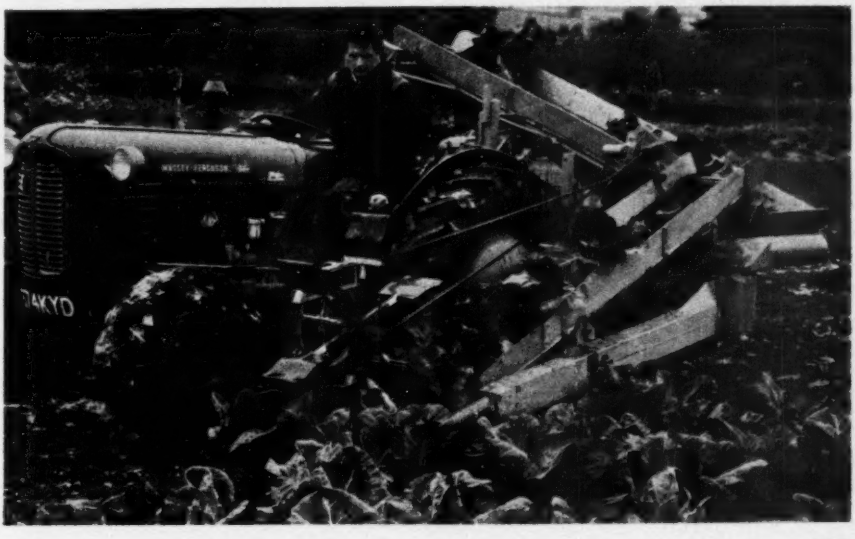
difference of two ounces of the active ingredient per acre may result in either a reduced crop or poor weed control. Machines for applying such chemical sprays need to be well designed and carefully used to achieve this accuracy. Simple, but highly efficient, band-sprayers are available for directed sprays and, when properly guarded against drift, they can be used even in close-row crops. This equipment makes it possible to use contact sprays in closely-spaced crops like spring cabbage and onions and to get close to crop rows. Pesticides also need to be applied at the right quantity and in the right place. Small granules of herbicide or pesticide sometimes have an advantage over liquids, e.g., they may be more persistent. Granule applicators are available to apply bands of granules, but spot applications are at present made with hand-operated applicators.

Irrigation is widely used in some vegetable crops. The application of water has been improved and the movement of equipment reduced since spray-lines were first used for this purpose. Well-designed, properly-spaced, rotary sprinklers can give a very even application of water with droplets which are not too large to compact the soil surface and an application rate which is not greater than the percolation of water through the soil.

Harvesting and preparing for sale

The cost of harvesting the crop is often a very high proportion of the total production cost and sometimes a large number of additional people are needed for short periods. The biggest advantage of manual methods over machines is the ability of the person to select the stage of maturity, the quality, and the size of the plant or part of the plant to be harvested. With almost all vegetables, full mechanization of harvesting a crop can only be worth while if the bulk of the crop matures at the same time, and the quality and size of the product are sufficiently uniform to reduce grading to a minimum. Where these conditions can be met, machinery will enable crops to be harvested more quickly, with fewer people, and consequently in better condition.

The N.I.A.E. vegetable harvester at work in spring cabbage in the Evesham district this year



Crops harvested by machine usually need to be graded for quality, size, degree of trimming, and other characteristics. This is sometimes an additional cost. It may, however, result in a better product. Peas, dwarf beans and carrots for processing are already mechanically harvested in a very efficient way. More recently, single-pick mechanical harvesting of Brussels sprouts, traditionally picked selectively in three to five successive harvests, has been done. The multi-purpose vegetable harvester designed at the National Institute of Agricultural Engineering will cut sprouts stems and elevate them into a trailer or bin. Stripping machines have also been designed here and in other countries to remove the sprouts from the stems. These developments will mean the adoption of new growing techniques and the careful choice of suitable varieties to produce the right plant and the right sprouts for easy mechanical harvesting of a series of crops which will mature in succession. Work is in progress at research stations and experimental stations to provide the means to do this. We are also looking ahead to the mechanical harvesting of more difficult crops, such as cauliflowers, but this is still in the very early stages. Even where machines cannot be used to harvest the crop, the work of manual harvesting can be eased and made more pleasant by mechanical handling. Some very efficient systems of handling cauliflowers from the field are operating in Lincolnshire, Kent and Cornwall.

Packhouse handling of vegetables, including trimming and cleaning the crop, grading and packing, is likely to become more common in future, to meet the needs of specialized markets and to fit in with mechanical harvesting. A wide range of specialist machinery for washing and sizing crops is already in use on many large farms or in packhouses, and mechanical handling of bulk loads is common.

Towards full mechanization

Full mechanization of all operations connected with the production of a crop, from the preparation of the land to getting the product to its point of processing or sale, is already possible with peas. It is likely to be the general pattern of vegetable growing in the future. The three main requirements are suitable plant material, proper growing techniques for the prevailing conditions, and suitable machines. The first is possible, although it will mean some new varieties and strict conditions of maintenance of purity of seed stocks and of seed production. The biggest problem with the second is our variable climate and wide range of soil conditions. Climatic and soil requirements may lead to greater concentration in more limited areas. The expertise needed by growers to use more precise techniques may well lead to greater specialization. There is little doubt that the engineer can produce the machines, although we may have to compromise to some extent to keep their cost at a reasonable level. We regard it as normal that we can buy a range of fruits of the size and quality which we need. Our demand for vegetables in similar ranges, with better continuity, will increase. Mechanization can greatly help the grower who is prepared to meet this demand.

T. Laflin, N.D.H., is the N.A.A.S. National Vegetable Specialist at the National Vegetable Research Station, Wellesbourne, Warwick. Before taking up this appointment last year, he had been Director of the Ministry's Experimental Horticulture Station at Luddington, Stratford-on-Avon, since 1958.

Coxes at Fernhurst

A Profitable Past — a Promising Future?

(2)

The second of two articles by

R. O. Cobham J. F. Crozier G. D. Lockie

'The past and present are only our means,
the future is always our end.' *Pascal: Pensées.*

ALL of us look to the future. None of us, though, growers and economists alike, can ever feel fully confident about our plans and predictions for the future; there are so many uncertainties. However, the job of planning profitable capital investment can be considerably eased if we have at our disposal records of the past, which, when analysed, can help to identify and quantify the factors responsible for our success or failure. In fact, the sole justification for the cost of keeping records is the use to which they are put in planning future policy. Records have shown that success at Fernhurst has been achieved by the fulfilment of the aim to obtain both high yields and prices and to control labour costs. These aims will continue to be the basis of the day-to-day orchard management. From further analysis of the Fernhurst records, coupled with some speculation about price and cost levels, a number of general guidelines for the future emerge.

Making the records pay

One of the greatest problems facing growers today is how best to manage their available capital resources. As indicated by Table 1, the capital requirements of an orchard, both per acre and per man, are extremely high.

TABLE 1

Comparison of fixed capital requirements*

(at present-day values)

Required by	Estimated amount of fixed* capital	
	per employee	*per acre*
	(£)	
Manufacturing industry	2,100	—
Agriculture	6,500	300
Chemical industry	8,000	—
The Fernhurst orchard	4,500	720

*Defined as land, buildings, plant and machinery.

With such large sums of capital involved, every grower needs periodically to question whether or not his overall investment has been, or will be, a good one. In particular, when an orchard nears the end of its economic life a grower will want to know if he would be financially justified in repeating this form of investment or if the returns are likely to be greater from other enterprises.

The 'real' returns to capital: a guide for the future

One answer to this question, in the case of both Fernhurst and any grower interested in starting an orchard on similar lines, lies in the calculation of what economists call the 'real' returns to capital. These are the returns which have been achieved when the effects of inflation are discounted by revaluing the outputs and inputs of an orchard business at present-day cost and price levels. In calculating these returns at Fernhurst, outputs have been revalued by taking an average of the prices received in the years 1963 and 1964, while inputs have been adjusted to a 1965 base by using a cost of living index. The performance of the Fernhurst orchard, even when put to this most stringent of economic tests, has been highly creditable. The average 'real' return to capital has been 14 per cent over the life of the orchard to date and has averaged 34 per cent over the last five years. By comparison, a speculator on the Stock Exchange would probably be more than pleased with an average 'real' return of even 8 per cent on his investment over the nineteen years.

Some growers may question the usefulness of these calculations as a basis for predicting future returns on the grounds that:

(*a*) the techniques, and therefore unit costs, of orchard growing are likely to be different in the future, and

(*b*) the relationship between price and cost levels is unlikely to remain the same as it was in the 1963 and 1965 period.

Such questioning is justifiable, but there will always be limitations to the assumptions that are adopted as the basis of any forecast. Nonetheless, the estimation of 'real' returns to capital does provide a grower with a useful guide when making his plans for future investment. The rate of return will, of course, be affected by changes in yields, costs and prices, but the effect of such changes on the rate of return can be calculated. For example, the Fernhurst records can be used to determine what the average yield, price and cost levels would have to be at Fernhurst before the future investment might be considered economically unacceptable, say, an average 'real' return of 5 per cent or less. These estimated tolerance limits are shown in Table 2. Calculations of this sort can obviously be of help to a grower and can be based on any number of assumptions that he wishes to make. If, following a comparison between the estimated 'real' returns from the replanted orchard and from a number of alternative enterprises, a grower decides that the orchard represents the most profitable form of investment, then records of the past can be of considerable help in both planning and implementing the details of his investment policy. Some examples are now given.

TABLE 2

Average yield, cost and price levels required to give an average 'real' return of 5 per cent during the first nineteen years of the Fernhurst orchard's life

Average 'real' return	Actual performance 14%	Speculative* performance 5%	Element of tolerance	
			Absolute	%
Components				
Av. yield (bushels/acre)	283 (19 yr. av.)	234	— 49	17
Av. cost per bushel	24*s.* (1965 level)	30*s.*	+ 6*s.*	25
Av. price per bushel	33*s.* (av. 1963–64)	27*s.* 6*d.*	— 5*s.* 6*d.*	17

*It is assumed that, for each calculation, two of the three variables (yield, cost and price) under consideration are kept constant at the actual performance levels.

Guidance on future investment policy

In view of the high cash requirements during the period which elapses before an orchard is established[1] and breaks even,[2] a study of cash flow diagrams[3] is of particular importance for growers both prior to, and during, the life of the investment. It is estimated that, on the basis of 1965 cost levels, the gross cash expenditure required to establish an acre of Coxes at Fernhurst would be about £1,450 (30 per cent higher than the cost in 1954). This includes the cost of land and all fixed or common costs. Obviously the cost will be much less for a grower who is replanting an existing orchard rather than starting from scratch. Where a grower's liquid cash resources are limited, the speed with which the break-even point can be reached is an especially important aspect to consider at the planning stage, as also is the type of marketing policy to be pursued. The latter will require much thought. This is particularly so if a grower is thinking of producing a high-quality apple and of marketing his fruit independently, since he may expect to have to meet a second wave of high cash commitments when the need arises to establish more elaborate marketing facilities.

Marketing facilities or a larger orchard?

Where capital is severely limiting for a grower aiming to produce yields similar to those at Fernhurst, he may question whether it would be more profitable to expand his tree numbers to the full and to intensify production or to concentrate on a smaller acreage initially and invest in marketing and

[1]The point of establishment is the year in which the *annual* cash receipts earned by the orchard exceed the *annual* cash expenditure incurred.

[2]The point of break-even is the year when the *total* or *cumulative* annual cash receipts exceed the cumulative cash expenditure.

[3]For greater details, see *Fernhurst Orchard—A Profitable Investment in Dessert Apples*, published by Plant Protection Ltd., pp. 21–26 and p. 46, and *British Fruit Farming*, by R. R. W. Folley and W. L. Hinton, University of Cambridge Farm Economics Branch Report No. 64, pp. 35–39.

storage facilities. From an analysis of the Fernhurst records, it appears that the best return would be obtained from investment in higher yields (i.e., trees, fertilizers, sprays, pruning, etc.) rather than in marketing facilities. Over the period 1956–64 the average returns to production capital (83 per cent) at Fernhurst were considerably higher than to marketing and storage capital (34 per cent).

What type of marketing facilities?

Likewise a grower, having decided that as a general policy he wishes to market his fruit independently, may question which is the most profitable type of marketing arrangement. Again help is to be found from past records, coupled with additional calculations. If the decision concerning the *general* type of marketing facilities required at Fernhurst was being taken today, it would not differ from that made in 1953. The reason will be apparent from Table 3, which shows that the investment in the sophisticated storage arrangement (controlled atmosphere store) at Fernhurst has yielded a return 15–20 per cent higher than the return which might have resulted from investment in a more simple (barn-type) storage system. The simple store, consisting of a single-skin building and estimated to cost about 12*s.* per square foot less than the existing facilities (about £2), would only have allowed the fruit to be marketed in the October-December period in contrast to the existing all-the-season policy.

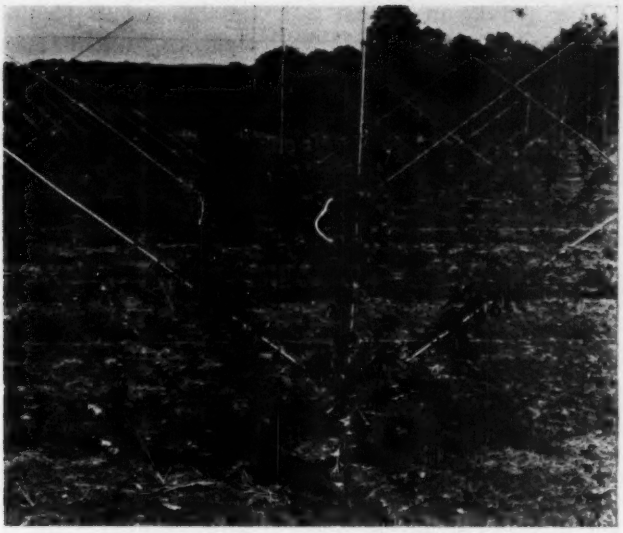
TABLE 3

Comparison between the estimated returns to capital invested in* (1) *the sophisticated storage facilities at Fernhurst and* (2) *a simple store*

	Sophisticated store (marketing throughout the season)	Simple store (marketing Oct.-Dec.)
Av. annual yield (bushels/acre)	511	
Av. differential in price per bushel compared with marketing off the field in October	Av. all-season price *less* av. Oct. price 43*s.* 2*d.* *less* 25*s.* 8*d.* = 17*s.* 6*d.*	Av. Oct.-Dec. price *less* av. Oct. price 34*s.* 7*d.* *less* 25*s.* 8*d.* = 8*s.* 11*d.*
Compared with marketing off the field in October	(£ per acre)	
Av. additional receipts	372	177
Av. additional costs	62	37
Av. additional profit	310	140
Av. additional capital	463	263
Av. % return	70	53

*All the figures shown in this table are averages for the period 1956–64.

The sophisticated storage and marketing facilities offer not only the chance of greater profits but also a higher rate of return on capital.



Young palmette trees at Fernhurst

The time to grub?

As a final example, management records can also be of particular assistance to growers who are faced with the problem of deciding upon the timing of their re-investment, i.e., the most opportune moment, in economic terms, for a grower to grub his orchard. The decision is a difficult one, since there are many factors to be considered, both technical and economic, which call for the combined thinking of grower and economist. From the physical records the grower can obtain some guidance on those matters demanding *technical* forecasts and judgments, such as:

(*a*) The likely yields in the years leading up to grubbing-out (at Fernhurst, probably in 15–20 years time). The main factors affecting these are likely to be tree population; the size of the tree and adequacy of fruit-bearing wood; the vigour of the current growth and the signs of senility and virus infection.

(*b*) The potential average yield of the replanted orchard on either the existing or a fresh site, bearing in mind that when 'pip is planned to follow pip' the site is usually left fallow or with alternate cropping for three to five years. Alternatively a grower might consider using an expensive partial soil-sterilizing programme which might, for example, cost £150—£200 per acre. A grower's long-term aim will be at least to maintain over the years an average annual profit which represents an economic return on his capital. In this respect the maintenance of high average yields is all-important as the major determinant of profitability and should therefore be given a high priority in deciding grubbing-up policy. It is believed that one feature at Fernhurst having a most important influence on yields is the quantity of fruit-bearing wood in the orchard. With current ideas on pruning, most fruit is carried on the young wood mainly on the outside of the tree in a zone roughly three feet in depth according to vigour of growth. Looked at in this way the fruiting area per tree increases with tree size. This size-to-yield relationship has in practice been accepted and is well exemplified by Italian and many French orchards. At Fernhurst a trial of intensive continuous row planting systems with a comparison of dwarf bush types is being made to determine the yields over conventional plantings so that an economic assessment of the three systems can be made. As these plantings progress and results emerge, visits from growers will be welcomed to discuss the possible implications for their own orchards.

(*c*) The extent to which it is justifiable to make small savings in costs in years of exceptionally low or steadily decreasing yields, e.g., it might be possible to omit the gloeosporium programme, thereby saving about £7 10*s*. per acre in materials.

The grower must first estimate the various technical possibilities. The economist can then be of help in trying to evaluate the economic implications and thereby provide economic guidelines for grubbing-up. With the aid of the grower, the economist's approach in stages is likely to be:

(*a*) Following an overall assessment of the future market outlets, to predict the likely price and cost levels for the grower in question.

(*b*) Using the predicted average price, cost and yield levels for the replanted orchard to calculate the future average gross margin and profit per acre.

(*c*) To estimate the likely phasing of additional capital and cash requirements (both gross and net of replanting and other grants).

(*d*) To calculate the likely returns from the proposed investment and from possible alternative enterprises.

It is likely that, in the event of choosing *not* to replant with fruit, only the annual production and marketing *variable* costs (fertilizers, sprays, casual labour, packages and marketing materials, agent's expenses, etc.) will be saved by grubbing-out. A large element of the fixed or common costs (permanent labour, services and maintenance, depreciation on storage and marketing buildings and equipment, etc.) will still have to be met. As a result the point at which grubbing-out becomes economically desirable is likely to differ from the time calculated when replanting is planned. The grubbing-out point is likely to be delayed when a whole fruit enterprise is due to be scrapped, since the grower, having invested a considerable amount of fixed capital in the orchard and marketing facilities, would be justified in trying to earn a reasonable return on his capital for as long as possible even though this may be lower than the returns which he expects to get from his new investment. The length of time that he should be prepared to forgo the extra returns of his alternative enterprise will largely depend on the extent to which his fixed capital in buildings and storage facilities can be put to alternative profitable uses.

Having considered all these factors, and in particular the possible alternative enterprises, and having listed all the necessary assumptions about the future, it is a relatively simple matter to calculate the grubbing-out point.

First the grubbing-out point should be defined, i.e., when the average yield of marketable fruit over two consecutive years has been below that which produces the acceptable gross margin of £**A** per acre, having allowed for the cost of grubbing-out and establishment. All that is required then is to determine the average gross margin per bushel (£**B**), which is its average price less the agent's commission, the production and marketing variable costs. $\frac{£\mathbf{A}}{£\mathbf{B}}$ therefore gives the average yield (**Y**) to produce the required gross margin per acre. Once the actual yield per acre falls below **Y** for two consecutive years, it is economically advisable that grubbing-out should be seriously considered. Details of this calculation are given at the end of the article.

Even when this calculation has been made, however, the decision about when to grub-out will depend to an extent on subjective judgment. In the final analysis it is the grower, not the economist, who will have to make the decision. It is suggested, though, that in coming to a decision, consideration of the economic factors outlined above would be fully justified.

Conclusions

In these articles an attempt has been made to demonstrate both the main factors responsible for the success at Fernhurst and the sort of help which growers can obtain from records in planning and managing their orchards. It is intended to give the impression not that figures can substitute for sound technical management, but rather that they are a very useful *supplement*. More refined planning tools than have been described in this article are now available to help growers. Obviously if growers wish to harness these in their fight against increasing competition and costs, it will be necessary for them to keep better records and to seek advice on how to use them with a view to increasing future profits. Successful management demands a combination of skills: there is much need for increased co-operation between growers and financial advisers.

Details of the grubbing-out calculation

Average acceptable gross margin per acre (£**A**) = Average gross receipts per acre *less* average variable costs per acre

$\therefore$ £**A** = Average yield per acre (**Y** bushels) × Assumed average price per bushel (£**C**)

less

{ Agent's commission (7½% of gross receipts per acre, i.e., 7½% × **Y** bushels × £**C**)

plus

Average yield per acre (**Y** bushels) × Assumed average variable production costs per acre (£**D**)

plus

Average yield per acre (**Y** bushels) × Assumed average variable marketing costs per acre (£**E**) }

$\therefore$ £**A** = **Y** bushels × £**C** *less* (7½% × **Y** × £**C** *plus* **Y** × £**D** *plus* **Y** × £**E**)

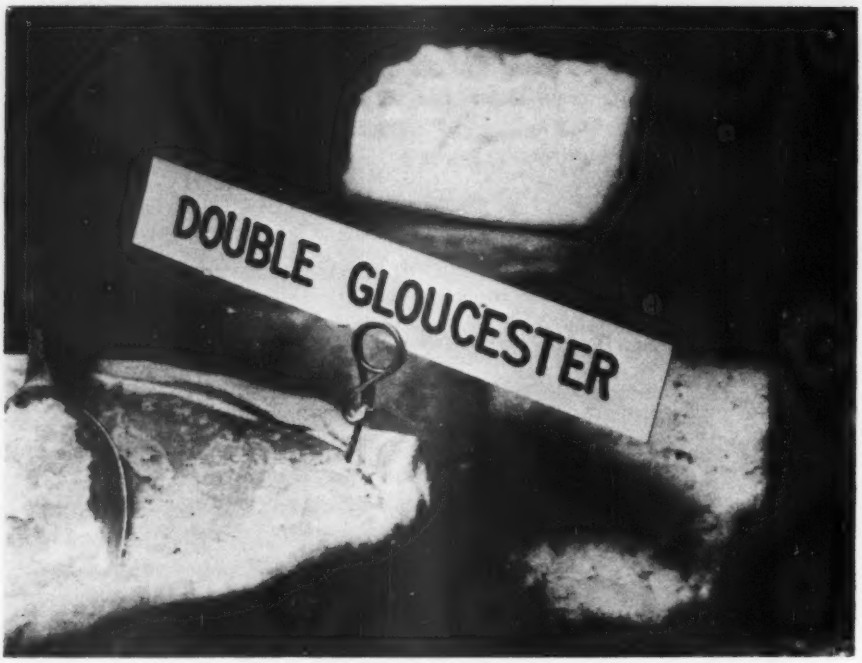
$$\therefore \mathbf{Y} \text{ bushels per acre} = \frac{\text{£}\mathbf{A} \text{ per acre}}{\text{£}\mathbf{C} \text{ per bushel } \textit{less } (7\tfrac{1}{2}\% \times \text{£}\mathbf{C} \text{ per bushel } \textit{plus } \text{£}\mathbf{D} \text{ per bushel } \textit{plus } \text{£}\mathbf{E} \text{ per bushel})}$$

$$\therefore \mathbf{Y} \text{ bushels per acre} = \frac{\text{£ Average acceptable gross margin per acre}}{\text{£ Assumed average gross margin per bushel}}$$

NOTE: Future variable production and marketing costs can be estimated from past records, since experience has shown that these variable costs tend to be relatively constant despite fluctuating yields.

(The first article on this subject appeared in last month's issue.)

CHEESE, SIR?



Kathleen Maddever

THERE is a dearth of written information about this particular variety of territorial cheese, but it undoubtedly originated from Gloucestershire where it was made on farms, those of the Berkeley Vale being noted for the quality of cheeses. In one of two books * written by a Mr. Marshall in 1796, entitled *The Rural Economy of Gloucestershire*, we read 'Gloucestershire has long been celebrated for its excellency in this art (cheesemaking) and where shall we study an art with so much propriety as in the place where it excels.'

As late as 1934 official recipes were being printed on the manufacture of the related variety known as Single Gloucester. It was not a cheese necessarily deficient in fat, as the name might imply, but was a variety made on the

*These books were kindly loaned to the author by Miss Avis Colnett, formerly County Dairying Instructress for Gloucestershire, who is the greatest living authority on Double Gloucester cheese manufacture.

farms at the beginning of the cheesemaking 'season', i.e., April and May, and was in consequence quick-ripening and not suitable for maturing. It shared with Caerphilly cheese the distinction of being possessed of special qualities as a toasting cheese.

Mild and mellow

Double Gloucester farmhouse cheese was in demand locally up to 1940, but was not made during the war years. By about 1953 the creameries took up the making of this variety, but it is not easy to produce the mild and mellow flavour, close texture and silky body when manufacturing in bulk. Pre-war, few cheeses were sold before they were 5–6 months old, but long maturing of this order presents the large-scale manufacturer with economic problems. Thus some of the true character of this variety of cheese has been sacrificed to satisfy the level of profitability necessary in modern methods of dairying.

The characteristic cheese is round and flat, about 6 in. high and 14 in. in diameter. It is usually coloured with annatto using 2–3 oz to 100 gallons of milk. Again, the book of 1796 is interesting: 'Annotta (note the changed spelling) is the produce of the plant Bixa Orellana. It is a tallish shrub, somewhat resembling the lilac. The colouring material is the pulp of the fruit, among which the seeds are bedded in a manner somewhat similar to those of the rose in the pulp of the hep. It is a native of the West Indies. Annotta Bay in Jamaica takes its name from this shrub'. The original cheeses were not coloured, but the weight of each cheese has stayed at about 30–35 lb. Because of their shape, these cheeses take up a lot of shelf space in the curing room which again adds to maturing costs per pound.

Present-day manufacture

Mixed evening and morning milk is used. The evening milk is cooled on the farm and subsequently pasteurized at the creamery. Starter is added at the rate of about 1 per cent with a one-hour ripening period, and as soon as the acidity of the milk is about 0·19–0·21 per cent rennet is added at the rate of 3–4 oz per 100 gallons of milk at a temperature of 86 degrees F. Annatto at the rate of 2–3 oz per 100 gallons of milk is mixed with three or four times its volume of cold water and added to the milk about 10 minutes before renneting. If the time difference here is too great the acidity in the milk may bleach some of the colouring and a streaky curd result. The coagulum formed by the rennet should be ready to cut in 35–45 minutes and be reduced to even-sized pieces about $\frac{1}{8}$ in. cubed using American curd knives. In olden days a 'breaker' was used. This was a rectangular series of criss-cross blades about 18 in. × 12 in. attached to a long, specially-shaped metal and wooden handle which could be used for cutting and subsequent stirring of the curd. These 'breakers' with brass frames and sometimes a brass holder for the wooden handle are now antiques; they were used only in round tubs which were usually made of copper.

After gentle cutting which should take 15–20 minutes, the curds and whey are stirred for a further 10–15 minutes and then the temperature of the whole is raised gradually to 94–98 degrees F, maximum temperature being reached about 50–60 minutes after start of cutting. As soon as the curd feels 'shotty', i.e., 10–15 minutes after 'scald or cooking' temperature is reached, it should

be allowed to settle on the bottom of the vat. The acidity at this stage should not exceed 0·17–0·18 per cent lactic acid. Whey is then drawn off, the curd being cut into 6 in. blocks. These blocks are turned every 15–20 minutes. If acid development is too quick the blocks may be broken again to make whey drainage more speedy.

The finished product

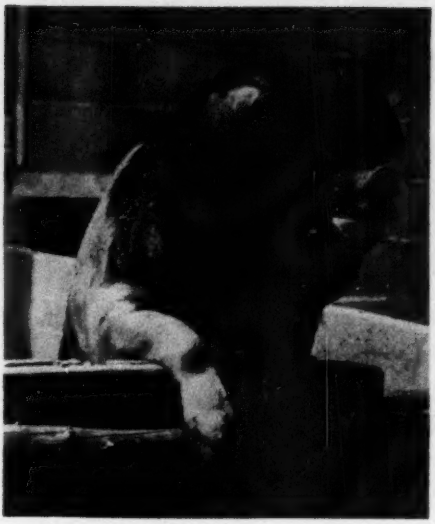
The curd is normally left in the vat until it is tough and dry, but on the farmhouse scale it used to be piled in layers, with cloths between each layer, the pile being covered with a wooden rack and a weight put on top. When the acidity is 0·6–0·75 per cent the curd is put through a Cheshire mill, i.e., it is ground quite finely and salt is added at the rate of $1\frac{3}{4}$ lb per 100 lb of curd. It should be possible to mill the curd $1\frac{1}{2}$–2 hours after drawing the whey. Before the acidimeter was invented the hot iron test was used—as it still is in many establishments where Scottish cheesemakers are employed! A small piece of curd about 2 in. × 1 in. is pressed on to the flat, heated surface of an iron blade. The curd is pulled gently away from the iron and fine threads of cheese will be produced. The length of these threads will depend on the proportion of acidity in the curd. The longer and finer the threads the greater the acidity, $1\frac{1}{2}$ in. representing about 0·75 per cent acidity. The salted curd when cooled to about 78 degrees F is packed into moulds and pressed for two days, at a pressure of 10 cwt for the first day and 15–20 cwt on the second day. The cheese is turned night and morning, put into a dry smooth cloth, greased and bandaged ready for the curing or ripening room. The original method excluded the grease banding but this made the coats liable to cracking if exposed to draught and this is a risk which cannot be taken on a commercial scale today. The temperature and humidity of the ripening are important, 50–55 degrees F with 84 per cent humidity being ideal. A well-made curd will give a yield of 100–105 lb of cheese per 100 gallons of good quality milk.

Average acidities

(*per cent*)

At renneting	0·19—0·2
After cutting	0·13—0·14
At pitching	0·16—0·18
At drawing whey	0·18—0·2
At milling	0·6 —0·65
From press	0·75—0·80

The author of this article, **Miss K. D. Maddever, O.B.E., N.D.D.**, joined the National Agricultural Advisory Service on its formation in 1946. Before that she served with the Agricultural Education staff of the Somerset County Council for 14 years. Since 1951 she has been Regional Milk Production Advisory Officer for the South-West Region, stationed at Bristol. Her article on Caerphilly cheese, in this series, appeared in June, 1964.



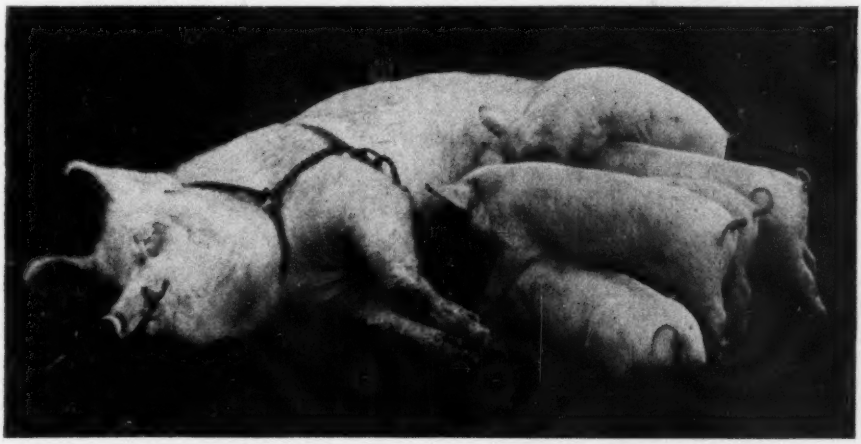
Pigs

Feature

containing articles by

Charles Dobson, A.R.I.C.S., who is one of the Ministry's farm buildings advisory officers and is stationed at Reading. Before joining the Agricultural Land Service in 1948, Mr. Dobson had experience with the West Riding County Council and the Air Ministry.

Raphael Braude, D.Sc., Ph.D., Anim.Husb.Dip., who is Head of the Pig Husbandry Department at the National Institute for Research in Dairying, University of Reading. Dr. Braude is Technical Secretary of the Pig Research Committee of the Agricultural Research Council, Chairman of the Pig Health Control Association, and a member of the Pig Commission of the European Association of Animal Production.



Farrowing to Fattening Houses

C. Dobson

FIFTY years ago it was a common practice to farrow pigs in a cottage pigsty and leave the progeny there until fat. The system had many advantages. Pigs were kept in separate compartments, with little mixing or moving of the animals. Disease spread was minimized and once the pigs were past the first few weeks their performance was usually good. Its disadvantages as a farrowing house, inaccessibility, high labour requirements, etc., led to other methods being developed. We have now reached a stage where pigs are often farrowed in a specialized pen, quickly moved to follow-on pens, then on again to a weaner pool, and finally into a fattening house. Progressive pig farmers are beginning to question the need for all these moves, with their high labour requirements, loss of pig performance, frequent cleaning operations, and so on.

One of the main reasons for using three or four stages in different types of buildings was the desire to keep buildings fully stocked in the hope that this would reduce capital costs per pig. But methods have been gradually changing over the years and it is now possible to design houses for a farrow-to-fatten system without any increase in capital cost over the three- or four-stage system.

Capital costs

Traditional systems vary a great deal but the three-stage method outlined below is very popular. Comparative capital costs for the buildings only for the traditional and farrow-to-fatten systems for a 48-sow herd would be approximately:

Three-stage method	£
4 farrowing crates in 'maternity' buildings (occupied by sows 10-14 days)	420
10 follow-on pens (4-5 weeks) (90 sq. ft each inclusive of feeding passage)	1,570
20 fattening pens (20 weeks) (140 sq. ft each including feeding and dunging passages)	4,900
	6,890
Farrow-to-fatten pens	
24 pens (150 sq. ft each including passages)	6,450
Portable equipment to farrow 8 sows	275
	6,725

JUST RIGHT!

Where good farming really tells: meat that's just right.

Controlled environment by electricity gives you healthier pigs (and healthier profits)

AUTOMATIC electric equipment (bought by itself, or already installed in special pig houses) controls temperature, banishes draughts, and changes the air constantly. Result: more profitable pig farming.

Find out more, now, from your Electricity Board, Electrical Contractor, Agricultural Machinery Dealer or Pig Building Supplier. Or post the coupon.

Electricity lowers production costs

To: The Electricity Council,
EDA Division, (R/A/15)
Trafalgar Buildings,
1 Cnaring Cross, London, SW1.

Please send me a free copy of your publication on controlled environment by electricity.

NAME .....

ADDRESS .....

.....

Issued by The Electricity Council, England and Wales

For farrow-to-fatten houses to be satisfactory it will probably be necessary to provide the following facilities.

1. All farrowing equipment, e.g., crate sides, creep lids and lamps, should be portable.
2. Litters should be able to mix from an early age.
3. Sows should be farrowed in batches so that all pigs in a house are about the same age.
4. Houses should be small or split up by partitions into small compartments.
5. Portable heaters should be provided for keeping up temperatures for small weaned pigs during cold weather.
6. About 20-25 per cent of the pigs will be extracted at the pork stage and the remainder carried on to bacon (or with some plan adjustments to heavies).

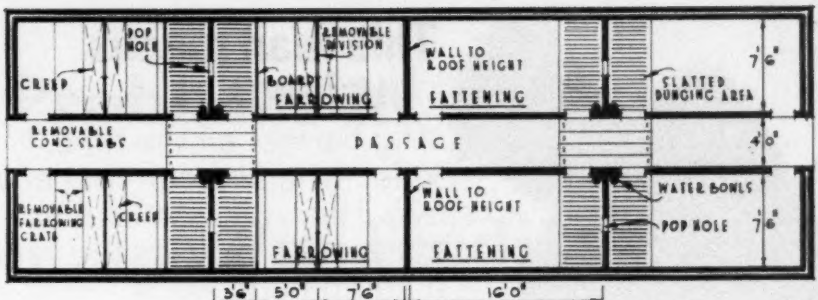
Two simple plans

There are probably many ways to provide these facilities, each with advantages and disadvantages. Two fairly simple plans are shown opposite. Both assume floor feeding and bucket watering of sows when crated. On many farms two or more sows are mixed quite happily in one pen soon after farrowing and the system works well. Advantage can be taken of this practice to design pens to take two sows during and after farrowing. If the sows are, after farrowing, to be loose in the one pen then layouts with creeps against the permanent partitions are probably the simplest solution. Alternatively, numbers in each pen can be evened out by mixing through pop holes with slides in partition walls. When each pair of sows is removed it should leave about 20 pigs in each pen. At the pork stage, each pig would have about 6 sq. ft (including dunging area) and 15 bacon pigs about 8 sq. ft each.

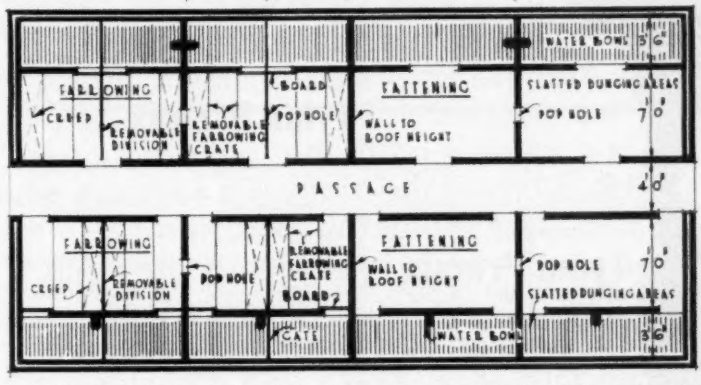
Plan 1 would probably be most useful in the adaptation of narrow buildings. The slatted passage across the building could have the bottom part of the end walls of the ducts sloped at about 45 degrees which should avoid the need for expensive underpinning of foundations. Water bowls sited next to the feeding passage would be easy to inspect and clean when necessary. The ratio of slatted area to feeding area is much more economical than in Plan 2, but access to the side of the house would be necessary for pumping out the dung. Sheet metal or plywood partitions on top of the slats would allow the duct to be 7 ft wide which would help to reduce costs. Plan 2 is closer to traditional ideas on pig housing and needs little explanation. Although both plans show slatted dunging areas, their adoption is not essential. With proper attention to detail, however, they work well and offer savings in labour. Dung is not scraped from passage to passage and this should also be helpful in preventing the spread of diseases, which is particularly important with young pigs.

Pumping difficulties

Many reports have been received about difficulties in pumping dung because of it drying out or, conversely, of too frequent pumping being required because of the dung being too wet. The cure and prevention of these faults is the same in both cases. The dung duct should be waterproofed to prevent liquids draining away or ground water entering into the duct through the walls and floors. Cement renderings, even with the addition of patent waterproofers, have often proved inadequate for this purpose. A continuous film of butyl rubber either inside the tank or under the floor and outside the walls would probably be a safer method.



PLAN 1



PLAN 2

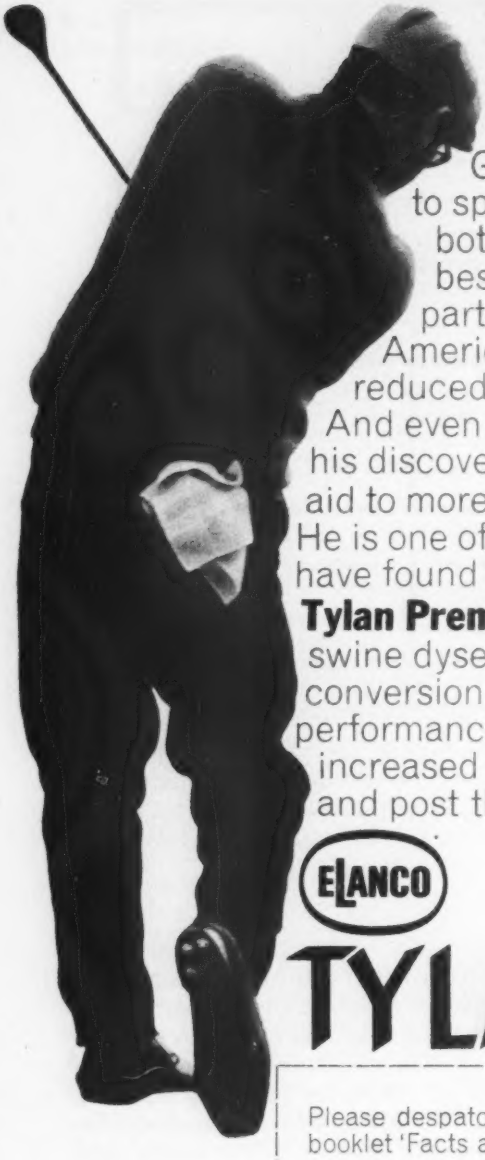
Where slats are adopted, piglets can be kept off them by 9 in. deep planks across the pen or across doorways. On at least one farm using a farrowing to fattening pen system where the slats are not partitioned off they are covered with sheets of $\frac{1}{2}$ in. thick boil-proof plywood which are removed 24 hours after farrowing.

Insulation and ventilation

The house should be well insulated and insulation materials protected with an efficient vapour barrier. Roof insulation should consist of at least 2 in. glass or asbestos or mineral wool, or equal. Assuming care is taken to conserve heat by adding this level of insulation, it would be folly then to allow heat to be lost by uncontrolled ventilation. A thermostatically-controlled fan system designed to give 5 to 20 cubic feet per minute per 120 lb pig would be advisable in both the houses illustrated. The lower figure is required *continuously* in the winter and the higher figure in summer. For a 48-sow herd six compartments each of four pens would be required, one compartment being emptied each month, cleaned and refilled with sows due to farrow.

Conclusion

The labour involved in moving pigs from pen to pen would be almost eliminated, dung cleaning considerably reduced, and the pigs should suffer fewer checks in growth. The time saved could be used to advantage in looking after more sows or better stockmanship or both. For many farmers the adoption of this type of system would be a break with tradition, a step not to be taken without caution. Probably the wisest course would be to try it out on a small scale first, possibly by adapting a few existing pens. Thus experience could be gained which would be invaluable when planning new larger units.



This man means business.

Pig Farmer all the time, Golfer when he can find any to spare. Highly successful as both because he uses the very best equipment. He is particularly pleased with a new American 3 iron which he swears reduced his handicap to four. And even more enthusiastic about his discovery of **Tylan Premix** as an aid to more profitable pig production. He is one of the many Pig Farmers who have found that the inclusion of **Tylan Premix** in pig feeds prevents swine dysentery, increases feed conversion efficiency and improves performance. Make *your* drive for increased pig profits; complete and post the coupon below TODAY.

ELANCO

TYLAN Premix

Please despatch, by return of post, a copy of the booklet 'Facts about **Tylan** for pigs.'

Name_____

Address_____

_____

Name of your feed supplier_____

_____

Elanco Products Limited, Broadway House, The Broadway, Wimbledon, London, S.W.19 Telephone: LIBerty 6600

AP2466

Problems in Pig Feeding

R. Braude

ONE could write volumes about problems in pig feeding. If one has to be very brief, one must be selective, and I intend to make a few comments on problems which are both topical and important. Increased productivity, based on increased efficiency, must become the keynote for the pig industry. In order to be efficient, a pig keeper will have to consider all the factors affecting performance and weigh up carefully their relative importance under the conditions prevailing in his enterprise. Circumstances will, of course, differ from farm to farm, but one will not be far off the mark in accepting the generalization that about 80 per cent of the cost of production of a marketable pig is, and will be, accounted for by the cost of feed. Feeding can either make or break the pig producer. Understanding of the problems involved in pig feeding is therefore of paramount importance. Our knowledge in this field is far from complete, but big improvements could be attained in the efficiency of the national pig herd if more pig keepers would make use of the accumulated know-how and experience about pig feeding. Other factors, like genetics, housing, management, etc., are, of course, also important, but one should keep a sense of proportion when dealing with them. There is, at present, a lot of loose talk on fashionable topics like hybrid pigs, new breeds, controlled-environment housing, automation and integration. This article is obviously not the right place to discuss these, except to say that one can be a very efficient pig keeper without paying undue attention to any of them.

Efficiency of feed conversion

When discussing current problems in pig feeding certain facts of life must be accepted. Currently, three criteria are used for assessment of performance: (1) efficiency of feed conversion (EFC); (2) carcass quality, including killing-out percentage; and (3) growth rate, in that order of importance. Economically, by far the most important is EFC, but for utmost efficiency one should endeavour to combine the best EFC with the leanest possible carcass and the fastest possible growth. Fortunately, all three factors are related to each other to some extent, and one can aim at the best of all three worlds. One must, however, be careful about definition of terms. EFC is meaningless unless it is associated with a declared composition of the feed. The latter can be manipulated to such an extent that comparisons of EFC should only be

made when similar types of rations are used. Beware of statements of very low EFC values. These may sometimes be due to the addition of fat to the ration. This is a procedure of very doubtful merit from the economic as well as other points of view which cannot be discussed in this article. Taking a typical British-type ration based on barley meal, wheat, wheat offal, and fish meal (all of average composition), one could nowadays classify EFC as excellent at, or below, 2·8 lb of feed per lb liveweight gain; very good at 3·0; good at 3·2; mediocre at 3·5; bad at 3·8; unacceptable at 4·0. These refer to average values for production of bacon pigs from 40 to 200 lb live weight. It is important to realize that, as the pig gets older and heavier, its EFC gets worse. It is therefore essential when comparing EFC to make certain that the values refer to the same period of the pig's life. For example, and as a very crude generalization, for pork pigs slaughtered at 120 lb live weight a reduction of 0·5 lb would be appropriate for each class given above, while for heavy pigs slaughtered at 260 lb an increase of 0·3 lb would be about right.

Carcass quality

As far as carcass quality is concerned, there is nowadays a general agreement to aim at the highest possible lean content. This is usually associated with a correspondingly low fat content. The amount of lean in a 200 lb live weight pig may vary considerably, but nowadays one can classify 55 per cent lean as good, 58 per cent as very good and 60 per cent as excellent. These percentages are based on the type of carcass dissection currently practised by PIDA, but one must appreciate the fact that different methods of dissection can give quite different values. Both the lean and the fat content of the pig can be considerably influenced by feeding. It is also important to keep in mind the fact that as the pig gets older and heavier the proportion of lean in its body decreases, while that of fat increases. As production of excess fat must be avoided, a pig cannot be efficient once it exceeds a certain live weight. It is a controversial issue what this maximum live weight should be, but my own view is that it should not exceed 200–220 lb, the range allowing for the different qualities of the pigs existing in this country.

I have called attention to the importance of killing-out percentage. This obviously applies only to pigs marketed on a deadweight basis. I believe that all pigs will in future be sold on a deadweight basis and, dare I say it, pigs of all weights will be graded for quality. The killing-out percentage improves as the pig gets heavier. If one adopts 75 per cent for a pig slaughtered at 200 lb live weight, the corresponding value at 120 lb would be about 70 per cent and at 260 lb about 78 per cent. One must, however, be very careful in comparing killing-out percentages. The time of the last weighing of the live pig in relation to the time of its last feed and to the time of slaughter may have a great effect on killing-out percentage. Considerable differences may simply be due to differences in gut-fill, and thus be of no real significance.

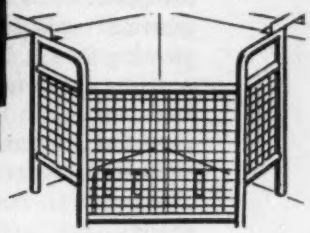
Rate of growth

One should aim at the highest possible rate of growth consistent with the best EFC. As the pig gets older and heavier, its growth rate increases until it reaches a maximum, followed by a decline. Many factors may affect the turning point and the rate of increase or decline, e.g., feeding, environment, management, to mention only a few, but with the present-day pig the climax

release valuable farrowing space with the

GUSH & DENT

NEW! PIGLET 'SANCTUARY'



Prices £14.12.6 painted £16.17.6 galvanised (PATS PENDING)

The Gush & Dent Piglet 'Sanctuary' relieves pressure on farrowing accommodation. Enables sow and piglets to be withdrawn *together* from farrowing quarters into a fattening pen without weaning. They can remain together for any period. Easily erected and dismantled. Completely portable.

- **Clamps easily to any pig pen in minutes.**
- **Sow proof: incorporates own feed and water trough.**
- **Provides controlled weaning.**
- **Extends cleaning and resting period of farrowing pens.**

SEND FOR DETAILS NOW!

TO: GUSH & DENT LTD.
ALRESFORD, HANTS.
TEL: 2641

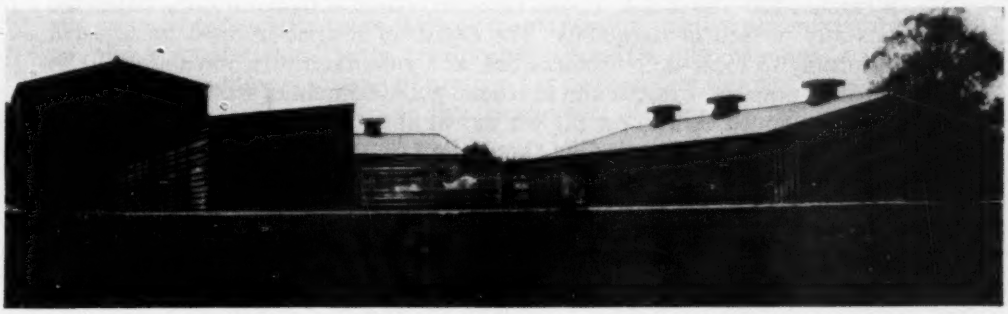
Please let me have details of your new PIGLET 'SANCTUARY'

Name .....

Address .....

..... A/8/PS

Also at Penrith, Cumb. Tel: 3741/2/3. Leek, Staffs. Tel: 1138. Torrington, Devon. Tel: 3258. Perth, Scotland. Tel. 25491 and Le Neubourg, Eure, France.



ANDOVER TIMBER

CO., LTD.

Full Range of Housing, Farrowing, Fattening, Sow and Boar Yards

WORKS AT

MYLEN ROAD, ANDOVER, HANTS. Telephone: Andover 3451/4

is reached at about 150–200 lb. Nowadays, an excellent growth rate at 40 lb live weight would be 1·4 lb gain per pig per day, and at 150 lb live weight, 2·0 lb gain per pig per day. As with EFC, one should refrain from making comparisons of the growth rate of pigs of different ages or weights. A pig growing rapidly will reach a specified slaughter weight sooner than one growing slowly. The reduction in the number of days will result in a corresponding cut in maintenance requirements, and this in turn usually means an improvement in EFC. There is, however, a catch here: if an animal puts on weight at a forced rate, its capacity to produce lean may be exceeded; it will deposit excess fat and its EFC will deteriorate.

I have been using definite values to illustrate some of the points, but when dealing with biological material as complex as the pig, one should really refrain from generalizations. What may be right on one farm, need not be right on a neighbouring farm. Feeds of the same name may be of quite different chemical composition. One should not expect to find a single magic formula for feeding pigs. Pigs, conditions of production, market requirements and economics are continuously changing and feeding standards and practices must be adjusted accordingly. To set a standard of efficiency worth aiming at, and I believe attainable within the next decade or two, I will be looking forward to a pig which will attain 200 lb live weight in 130 days, with an EFC at 2·2 lb per lb gain (on the type of feed mentioned earlier) and a lean content of 62–64 per cent (as defined earlier).

Some current problems

With this background in mind, I would like to comment on a few current problems associated with pig feeding. I believe that in order to be efficient, one must nowadays restrict the amount of feed given to the growing pig after it reaches 120–130 lb live weight. One can restrict it by controlling either the quantity of feed or its quality. The degree of restriction must be adjusted according to local circumstances but, as a rule, the restriction should be as small as possible. I would aim at reaching a maximum of 6·5 lb meal (of the type mentioned earlier) per pig per day at about 160 lb live weight. This is a level which a good quality pig should be able to utilize efficiently. Pigs fed the same ration *ad lib.* would certainly grow faster but their EFC and carcass quality would be adversely affected. Controlled feeding has another advantage which is often overlooked. It allows one to spot early any pig that for one reason or another may be off colour, and thus apply the necessary treatment sooner than would be possible on an *ad lib.* feeding routine. On the other hand, restricted feeding requires a little more labour. It is, however, of great importance to make certain that the saving in labour on *ad lib.* feeding is not annulled by losses in EFC and carcass quality. Under the present conditions of pig keeping in this country, it is false economy to save labour by using an *ad lib.* feeding regime.

There is now reasonable evidence to indicate that under many conditions once-daily feeding may be safely practised without adversely affecting the performance of the pig. Feeding off the floor, instead of the more usual trough feeding, is now quite acceptable, provided pellets are used in preference to meal. When floor feeding is practised, the main advantage from pellets comes from the reduction of waste, but also with trough feeding pellets seem to give slightly better results than meal. The reasons for the latter difference are not yet fully understood, but one could speculate that the heat treatment

involved in pelleting enhances the nutritive value of the ingredients of the ration. On the other hand one must recognize the fact that overheating may adversely affect the nutritive value of the feed.

There appears to be very little difference between dry and wet feeding, but under some conditions wet feeding may enhance the performance. The ratio of meal to water of 2–3 to 1 is usually recommended, but a 4 to 1 ratio, to facilitate 'liquid' feeding by pumping, is also quite acceptable.

There are indications that the idea that thorough mixing of ingredients of rations for pigs is essential may not be with us for much longer. After all, human beings do not require a properly balanced diet at each of their daily meals, provided, of course, the overall balance of nutrients is adequate. I would not be surprised to see in the near future pigs fed separate 'courses' of cereals, protein, vitamins, minerals all at the same or at different meals. A large-scale test now in progress should help to reach a decision on this issue.

Amino acids

The last topic I wish to mention is the problem of amino acids. It is a subject on which a lot of loose talk is reaching the farmhouse. It is, of course, a fact that amino acids are the building stones of protein, and as such are of very great importance. Protein quality in feeds will in future no doubt be judged by their amino-acid content. However, I am convinced that, at present, it is premature to think of supplementation of practical pig rations with synthetic amino acids. This is not only because their cost is still prohibitive, but mainly because our knowledge in this field is not yet adequate. The most exciting recent development in this area, which may completely revolutionize pig feeding in the future, is the discovery by scientists at Purdue University in America that they can alter and improve the amino-acid content of maize. If all expectations of this discovery are eventually realized, and this may take several years, it may become possible to grow pigs efficiently on maize supplemented with 'condiments' (minerals and vitamins) only, without any additional sources of protein. Let us hope that this new development will prove to be a complete success and that other cereals will quickly be subjected to similar improvements.

Taxation and Capital

Introduction to a Series

A. J. Davies **H. A. Thomas**

THE role of the N.A.A.S. in advising farmers how to improve their individual farm businesses has hitherto been directed mainly to reorganizing the current farming systems, with a view to increasing the annual net farm income. Examination of balance sheets has only been necessary when capital has been a restricting factor. Considerable emphasis is being given at the present time, however, to the return on capital.

The method of appraisal varies from a simple calculation of the return of interest on the total amount of capital invested, to using discounted cash flow methods, making due allowances for the appropriate levels of tax appertaining at the current time. In assessing alternative future farming systems the adviser and the farmer have to bear in mind provision for living expenses, current interest charges, further expansion, the payment of annual taxes, payment of capital gains and, ultimately, payment of estate duty. There is continual pressure to increase the size of the business, thus obtaining benefits from the economies of scale. At the same time as size increases, the demand for additional capital increases; this ultimately increases the long-term liability for capital gains tax and estate duty.

There are, of course, various ways in which this situation can be anticipated by the provision of an insurance policy or investment of a certain proportion of income throughout the life of the occupier to meet these demands. Other alternatives are the formation of companies, partnerships, or creating discretionary trusts, but due to the possible higher amounts paid in annual income tax most farmers have opted to remain private concerns. Current legislation, and undoubtedly future legislation, will need careful professional interpretation by accountants and solicitors. Individual farmers would be well advised not to make their own decisions without obtaining the best professional advice on the longer-term aspects.

The N.A.A.S. role is unlikely to change, i.e., to ensure that current resources are being utilized to meet the objectives of the individual farmer. Nevertheless, it is important that management advisers and farmers should have a better appreciation of the effect of taxation on present and future capital. It is therefore proposed to publish a series of short notes in *Agriculture* with the aim of creating a better understanding of the present tax situation and the role of capital in present and future farm businesses. The notes cannot, of course, be any substitute for professional advice, and for any specific problem a farmer should consult his accountant or solicitor.

The first article in the series will appear in next month's issue of *Agriculture*.

Rabbit Control by Cyanide Gassing

Harry V. Thompson and R. H. Thompson

FOR over ten years Britain has been relatively free from rabbits, with quite obvious benefits to agriculture and forestry. But rabbits have never completely disappeared over any sizeable area, although their numbers could often be estimated in tens or hundreds of acres per rabbit, instead of the two or three rabbits per acre that was common before myxomatosis.

Waning influence of myxomatosis

Scientific opinion was unanimous, despite the virulence of the disease, in forecasting that the effect of myxomatosis would gradually diminish and that there would be a continuing need for traditional methods of rabbit control. The vagaries of myxomatosis were discussed at some length in the May issue of this journal and attention drawn to the following points: that myxomatosis is permanently established as a disease of rabbits in Britain; that the original highly virulent strain of virus has been replaced by weaker, i.e., attenuated, strains in many areas; and that, as in Australia, rabbits with inherent resistance to myxomatosis are likely to survive in increasing numbers by a process of natural selection. It is inevitable that the influence of myxomatosis as a factor controlling rabbit numbers will continue to wane until some position of relative stability is reached between the rabbit and the disease. It is equally inevitable that any natural level of rabbit numbers will be much too high for the farmers' comfort. In some areas, rabbits are already reaching pre-myxomatosis numbers, hence the need for organized control. Shooting, snaring, trapping, ferreting, long netting and the use of dogs all have their place on occasion but, wherever rabbits are living in burrows, cyanide gassing is, when it is practicable, the most humane and efficient means of killing rabbits.

A recently-introduced model of a petrol-driven machine used to pump cyanide powder into rabbit burrows

Pump-gassing and spoon-gassing

The cyanide is used in the form of powdered compounds which, in contact with moist air, evolve hydrocyanic acid gas. The powder is either pumped into the burrow in considerable quantities or laid, in smaller amounts, just inside the hole entrances. In both cases it is essential that all surface-living rabbits should be shot or driven into their burrows by dogs, before gassing begins. The pumping method is more efficient for large, well-populated warrens, and is economical of time, labour and materials. Hand-operated and petrol-driven pumps are in use and experiments have been carried out with both types. The illustration on this page shows a recently introduced model of a petrol-driven machine. When using a pump, the procedure is to apply sufficient powder to generate a lethal concentration of gas throughout the warren. The powder is pumped in at one or more holes until it shows as a 'smoke' at all the untreated holes, which are then blocked with turves and earth. There should be no preliminary blocking of holes, because unless these are re-opened by rabbits they form blind tunnels, less readily penetrated by the cyanide powder. Rabbits occupying such tunnels might not receive a lethal dose of gas.

The placing of a small amount, about an ounce, of powder down a burrow is usually referred to as 'spoon-gassing' because of the means of laying the powder. This method is more economical for small infestations or for dealing with relatively small numbers of rabbits which have survived other methods of control. All the rabbit holes are blocked with earth and, after two or three days, a level tablespoonful of cyanide powder is laid in a small heap about six inches down every burrow that the rabbits have re-opened. Each hole is then blocked with turf, with the grass side inwards to avoid covering the powder with earth. A lethal concentration of gas builds up for about a foot down the burrow and persists for some 24 hours or more. Rabbits attempting to dig their way out are overcome by the cyanide.

Tests of efficacy

The concentration of hydrogen cyanide necessary for effective results is known from the physiological work done many years ago by Sir Joseph Barcroft. It is thus possible to compare the performance of various proprietary brands of cyanide gassing powder and the effectiveness of different techniques of application by measuring the concentrations of gas built up in the warren. Work of this type has been done by the Ministry's Infestation Control Laboratory over a period of several years. The technique used consists in placing narrow-bore tubes in the warren, terminating at the places at which it is desired to measure the concentration and with their free ends at a convenient position above ground. Samples can then be taken by connecting an evacuated flask to the end of each tube and the amount of cyanide drawn in can be determined by chemical analysis. The photograph below shows a set of flasks in position in a small warren in woodland with a prototype gassing machine in the background.

Spoon-gassing tests

Tests have been made in artificial burrows; in a warren excavated to trace the course of the burrows and subsequently covered over again with timber and earth; and in natural burrows in a variety of situations. In each case the standard quantity of powder (approximately an ounce) was placed 6–12 inches from the entrance and concentrations were measured over the heap of powder and at a point one foot beyond it. As might be expected, the concentrations varied widely from one warren to another but it was clear that all the powders tested were able to maintain an adequate concentration at the mouth of the burrow for a satisfactory period of time and there was little to choose between them. The variations between one powder and another, which extended to composition, colour, particle size, available hydrogen cyanide content and rate at which the cyanide was given off, did not materially affect their suitability for this method of application. It was concluded that any of them would give effective results provided the correct procedure was followed, i.e., driving surface-living rabbits into the warren beforehand, blocking up the holes correctly, and so on.

Sampling flasks in use during tests on the concentration of hydrogen cyanide built up in a rabbit warren

Pump-gassing tests

With pump-gassing the choice of powder is more restricted. It must on the one hand be light in colour so that it can easily be seen emerging from the holes and it must be of low bulk density so as to pass freely through the warren and not all settle near the point of entry. In addition, it should release its hydrogen cyanide content fairly quickly. Most of the calcium cyanide powders used for the spoon-gassing tests failed on the first two of these counts and some on the third as well. The tests carried out by the Ministry were all done on a sodium cyanide based powder and the measurements were designed to investigate the performance of various types of pump and impeller, not that of different powders. The work was done in the warren which had been excavated and whose configuration was known. This enabled sampling tubes to be placed at several points throughout the warren, including blind ends where concentrations might be expected to be low. The results showed that effective concentrations were built up at all sampling points when a motor-driven impeller was used, but only within a few feet of the point of insertion of the powder when a hand pump was used.

Conclusions

The measurement of concentrations of gas built up in rabbit warrens in various situations has shown that cyanide gassing using either the spoon- or the pump-gassing technique is capable of giving effective control of rabbits. The method to be selected in any particular instance depends on the size and situation of the warren. The brand of powder used is not of overriding importance except that for pump-gassing it should be light-coloured, free-flowing and not too dense as well as releasing hydrogen cyanide fairly rapidly. For use in power-driven machines the gassing powder should be packed in a container that can readily be attached to the machine, to avoid having to transfer so toxic a substance from one container to another.

Harry V. Thompson, B.Sc., F.I.Biol., is a Senior Principal Scientific Officer and Head of the Land Pests and Birds Research Department of the Ministry's Infestation Control Laboratory. His co-author, **R. H. Thompson, B.Sc., A.R.C.S., D.I.C., A.R.I.C.**, is a Principal Scientific Officer in the Chemistry Department of the Laboratory.

Fattening Store Lambs on Hill Farms

G. L. Williams • R. Andrews

TRADITIONALLY, hill wether lambs are fattened on grass aftermath, rape, turnips or swedes, supplemented by some concentrates. This can only occur on hill farms having a reasonable arable acreage, but by and large these store lambs are sold to lowland farmers for finishing. There is usually little difficulty in selling the forward class of lamb, especially if marketed well before September. The disposal of the smaller second class of lamb is, however, a real problem to hill farms collectively and individually. Any method of reducing the number of small lambs coming on to the market in the autumn should improve the prices received for the better class of lambs. Similarly, hill farmers would be less dependent on selling on a weak market in the autumn if the poorer lambs could be retained and fattened over winter, aiming at the stronger market for fat lamb prevailing in the first quarter of the year.

The use of urea

High-concentrate diets have been used successfully for the larger type of cross-bred store lamb for some time but few reports are available on the response of hill lambs to such a system. As these diets are usually based on barley and conventional sources of protein, any method of reducing the cost of feed would be welcomed. One possible answer is to replace some or all of the conventional protein with urea, a much cheaper source of nitrogen. This practice is increasing in the preparation of supplementary concentrate mixtures for cattle and sheep but the inclusion of urea in all-concentrate rations is still in the developmental stage.

Urea is a simple non-protein nitrogenous compound, costing about 10*d.* per lb of nitrogen, as against conventional protein sources at about 5*s.* 7*d.* per lb of nitrogen, which the rumen micro-organisms of cattle and sheep can synthesize into useful proteins for their host animals. Owing to its high

solubility, urea is rapidly hydrolyzed to ammonia and carbon dioxide in the rumen. Large doses give rise to ammonia at too fast a rate for the bacteria to convert to true protein and the excess is absorbed into the blood stream too quickly for the kidneys to excrete it. Consequently blood ammonia levels increase to toxic quantities. However, experimental work has shown that certain dietary specifications can minimize this danger. Provision of a regular supply of energy from a carbohydrate source that is neither excessively insoluble nor too rapidly fermented, assists the bacteria to incorporate into true protein the ammonia released by hydrolysis of the urea. Self-feeding of concentrates is therefore admirably suited for the inclusion of urea, ensuring that both urea and carbohydrates are ingested in small but regular amounts.

The Bangor experiment

During the winter of 1964–5, a small trial was carried out to try to provide answers to the following questions:

(1) Can hill wether lambs be profitably fattened on all-concentrate rations?
(2) Can urea replace part or all the supplementary protein provided by conventional sources?
(3) How important is the initial live weight of the store lamb?

The trial consisted of three diets, based on the rolled barley plus protein supplement (85 : 15) type used for intensive beef systems. The first acted as control and in the second (0·9 per cent urea) and third (1·7 per cent urea) soya-bean meal was replaced by locust-bean meal and urea, the latter supplying 20 per cent and 40 per cent of the dietary nitrogen.

Composition of the diets

	Control	0·9% urea	1·7% urea
Rolled barley	85·0	85·0	85·0
Soya-bean meal	11·0	5·5	—
Urea	—	0·9	1·7
Locust-bean meal	—	4·6	9·3
Minerals and vitamins	4·0	4·0	4·0
Crude protein (N × 6·25)% of dry matter	17·0	16·2	16·2
Calculated metabolizable energy Mcal/kg. dry matter	2·93	2·92	2·92

During the change-over period of two weeks from pasture to concentrate feeding some lambs (8 per cent) refused to eat and had to be discarded before the experiment proper started. This problem was largely of our own making, since we deliberately left out roughage from their diet. Subsequent experience here and elsewhere has shown that the majority of hill lambs can be taught to eat concentrates when some good-quality hay is also offered.

Sixty Welsh mountain lambs of average weight 43·3 lb (range 32–64 lb) were split into six groups, three of which were sheared. One shorn and one unshorn group was allocated to each of the diets, which were given in self-feed hoppers. They were housed in indoor pens, bedded on sawdust, and no roughage supplied. At the beginning of the trial each lamb was implanted with a 15 mg pellet of hexoestrol, injected with pulpy kidney vaccine and dosed with Thiabendazole.

Results

The trial lasted twelve weeks, by which time the lambs had an average carcass weight of 36 lb and a killing-out percentage of 49·2.

Performance of wether lambs

	DIETS					
	Control		0·9% urea		1·7% urea	
	Unshorn	Shorn	Unshorn	Shorn	Unshorn	Shorn
Initial weight (lb)	43·1	43·3	43·6	43·4	43·4	43·1
Weight after 12 wks (lb)	72·2	70·2	68·9	68·1	68·1	74·1
Daily gain (lb)	0·38	0·34	0·33	0·33	0·24	0·39
Dietary mean	0·36		0·33		0·31	
Food conversion ratio	5·3	6·2	6·2	6·0	7·4	5·4
Dietary mean	5·8		6·1		6·4	

The performance data is rather marred by the completely non-typical behaviour of the unshorn 1·7 per cent-urea-fed lambs as a group. Nevertheless, the differences between treatments in liveweight gain are not statistically significant. The heavier lambs, because of their better reserves, were better able to withstand the fairly severe check in the first few weeks on the concentrate diet than the smaller ones. After the first weeks on treatment the weight gains of the lambs were not influenced by their starting weight and the large and small lambs did equally well. From the marketing point of view the initially larger lambs were ready to slaughter at a time when grass-fattened lambs were available, while the smaller animals were sold at higher prices per pound in February. Shearing tended to increase feed intakes slightly but daily gains were not improved. Two pounds of wool, worth six shillings, were obtained from the shorn lambs at the beginning of the trial and the re-growth of wool was sufficiently long for the lambs to qualify for the woolly lamb price when slaughtered.

Replacing soya-bean meal by urea reduced feed prices, the cost of three diets, control, 0·9 per cent urea and 1·7 per cent urea, being 2·98, 2·86 and 2·80 pence per lb. The store lambs were initially valued at 1*s.* 6*d.* per lb live weight and the average price received for a carcass was 3*s.* 6*d.* per lb dead weight. Some economic data is presented below, where the influence of the fleece value is immediately obvious.

	DIETS											
	Control				0·9% urea				1·7% urea			
	Unshorn			Shorn	Unshorn			Shorn	Unshorn			Shorn
Mean carcass weight (lb)	35·6			36·0	36·2			35·9	32·3			39·1
Receipts	£	*s.*	*d.*	£ *s.* *d.*	£	*s.*	*d.*	£ *s.* *d.*	£	*s.*	*d.*	£ *s.* *d.*
Carcass value	6	4	7	6 6 0	6	6	8	6 5 7	5	13	0	6 16 10
Value of fleece	—			6 0	—			6 0	—			6 0
Total receipts	6	4	7	6 12 0	6	6	8	6 11 7	5	13	0	7 2 10
Less cost of feed	2	5	8	2 6 11	2	8	10	2 10 4	2	0	7	2 13 10
Intial cost of lamb	3	4	6	3 4 9	3	5	3	3 5 0	3	4	10	3 4 6
Costs	5	10	2	5 11 8	5	14	1	5 15 4	5	5	5	5 18 4
Margin per lamb*	14	5	1	0 4	12	7		16 3	7	7	1	4 6

* This does not include any charges for labour, housing, medicines or allowance for lamb mortality.

Conclusions

On reflection we believe that the success of this enterprise depends on the following factors:

(1) *Value of store lamb.* Our smaller lambs did not appear to be handicapped in their ability to fatten successfully. We know full well how difficult it is to dispose of them as stores and suggest that these rather than the stronger lambs are the ones to finish at home on *hill* farms.

(2) *Price of food.* Our concentrate mixtures were rather expensive because we were dealing with a small number of sheep. Similarly, smaller producers should co-operate together to buy in bulk at favourable prices.

(3) *Food conversion ratio* depends on breed, ration and a smooth change-over from pasture to dry feeding. The overall average of 6 : 1 attained by our Welsh mountain lambs compares very favourably with many lowland breeds. Achieving a smooth change-over is a skill of husbandry, but a limited supply of good-quality hay appears to be an essential ingredient for success. Inexpensive housing with adequate ventilation, trouble-free self-feed hoppers strategically sited away from corners, and plenty of water, are other obvious features. Little is known of the protein requirements of this type of lamb and it may well be possible to use only barley, minerals and vitamins. But assuming that additional protein is required, urea can provide at least 20 per cent or more of dietary nitrogen provided the coarse meal is supplied in self-feeders *at all times*.

The profit margins from this system are not large, but at least it offers more security and independence to the hill sheep farmer than the uncertainties of the store market.

Gwynn Ll. Williams, B.Sc., M.S., is Lecturer in Animal Husbandry at the University College of North Wales, Bangor. He is responsible for the experimental sheep flock there and has pioneered performance and progeny testing of Welsh mountain rams.
His co-author, **Richard Andrews, B.Sc.(Hons.)**, graduated at the University College of North Wales and is now a Ministry of Agriculture post-graduate scholar working on aspects of lamb nutrition at the Rowett Research Institute.

BRITISH AGRICULTURAL EXPORT COUNCIL

THE main function of the British Agricultural Export Council is to integrate and co-ordinate the export efforts of British agriculture and the industries associated with it. Activities of the Council will include:

Organizing missions abroad to undertake market research and promote sales.

Arranging visits for foreign businessmen and buying missions.

Supplying information on export opportunities to members.

Arranging British participation in shows and exhibitions abroad or the mounting of British Shows abroad.

Making the fullest use of facilities at shows in the United Kingdom for attracting foreign buyers.

Publicity for all these activities.

An important role of the new Council is to act as an intermediary between exporters and bodies such as the British National Export Council and the Overseas Fairs Branch of the Board of Trade which grant-aid promotional operations designed to increase exports.

Black as a sweep from the blowing peat, a Fenman makes for home

Erosion Control on the Black Fens

N. J. Sneesby

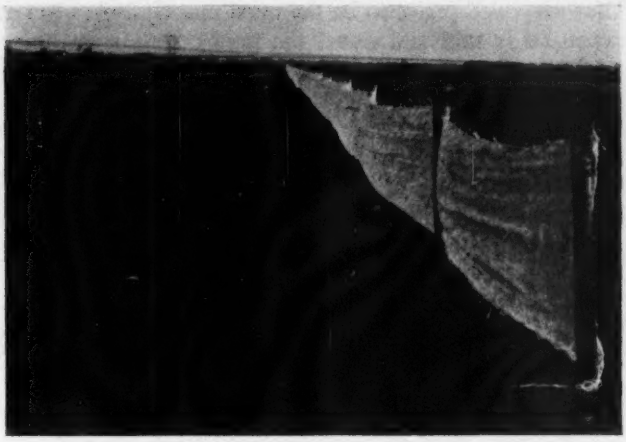
METHWOLD FEN is a remote part of south-west Norfolk, where the peat is up to twelve feet deep and the soil as fertile as any in the black fens, but where the curse of wind erosion lies heavily over the land. Here the fear of losing soil, crops and fertilizers in a mighty cloud of dust is one which induces chronic insomnia in local homesteads. Crops like lettuce, carrots and sugar beet are particularly vulnerable to damage from wind action both before germination and at the seedling stage. The seeds may be carried away with the soil to find a resting-place in drainage channels all over the district; the young plants are uprooted, twisted and battered, or buried under blown dust. But there is at least one holding on which this worry is rapidly becoming a thing of the past. It is Broad Fen Farm, a 600-acre all-arable unit. Messrs. F. M. and H. J. M. Darby have introduced a close-knit and efficient system of windbreak protection based on willow hedges, single rows of barley and movable hessian screens. Of the numerous methods which farmers all over the fens and sandy Breckland have adopted to control, or attempt to control, 'blowing', including the planting of tree belts, strip-cropping, claying, and spraying with water or a starch solution, this three-fold system is considered to be the most practicable on this particular unit, where only intensive crops are grown.

A hedge as windbreak

The basic and permanent protection is afforded by double rows of 'red willows' planted about two feet apart; the cuttings root rapidly on this soil and the failure rate is very low. This is a naturally-bushing variety and the cuttings have their tips removed to induce low branching. The oldest of the hedges, planted about ten years ago, has reached a height of about 12 feet, which is adequate, with the additional protective measures outlined below, to protect a 10-acre field, especially where, as on this farm, an extensive network of such hedges results in a cumulative reduction of the wind strength. The effect of the wide-spread hedge cover is to produce a micro-climate which is rather more humid than in the open fenland; this slows down the rate of drying-out of the surface layer of soil and accordingly further reduces the blowing risk, but it does slightly increase the possibility of blight. These hedges are still being planted and the ultimate aim is to split up all fields to a 10-acre maximum, each completely surrounded by a thick willow hedge. Obviously there must be access gaps, and it is well known that these tend to induce a draught effect whereby the soil to leeward of the gap is severely scoured, but by judicious siting of these field accesses to prevent a long wind 'fetch', this can be reduced if not entirely eliminated. On peripheral fields, where the wind force is at its strongest, or where very tender plants are grown, it may be necessary to plant low interior hedges at intervals of about 30 yards.

The willow hedges are trimmed mechanically once a year. The hedge bottoms are full of nettles which make rank growth on this rich soil; in the past they have been controlled by spraying but the succeeding growth of annual weeds, from which seeds blow all over the fen, is more detrimental to farming than the nettles, which in fact provide an excellent 'bottom' of shelter for the hedges. There are, of course, consequences which have to be put on the debit side when hedges are planted: competition for food and moisture, which makes it not worth while to drill right up to the hedges; the shading of plants, which draws them up to make them weak and spindly; the haven provided for harmful birds; the increase in the rabbit population in the dry ground below the hedges; last but not least, the use of land which

Rows of barley planted on Broad Fen Farm to give protection to sugar beet. On the right, a willow hedge affords a permanent shield against 'blowing'



A movable screen of hessian strips sewn on to wire netting is being used here to protect freshly-sown lettuces

would otherwise be productively cropped. But the final analysis is an economic one, a judgment by the individual farmer as to whether the planting is on balance worth while, and Messrs. Darby are in no doubt about the answer.

Subsidiary measures

On a 10–acre field, however, 12 ft hedges will not prevent erosion entirely, and since mechanized farming demands a field of this minimum size, subsidiary measures have to be taken to protect the soil and growing crops from the wind. Though its force will have been much blunted by the system of hedges, this will still often be sufficient to disturb the soil and buffet tender seedlings. The two systems used on Broad Fen Farm are intercropping with single rows of barley and the use of movable hessian screens. The barley is drilled if possible before the sugar beet, celery and carrots, in alternate rows with these crops; if conditions permit this to be done, some protection is provided for the seedbed and germinating seeds. Rye and wheat have been experimented with, but barley produces a dense row more rapidly and is moreover easier to destroy. The barley is normally removed by a rotavator in late May in two operations, the debris being allowed to remain on the surface where it continues for a short time to protect the growing crop. Apart from the protection given to the crops named, barley rows have been sown to protect black currant cuttings and strawberry plants from buffeting in the early stages of their growth.

The hessian strip method is used primarily for the protection of lettuce and daffodils. Posts are driven into the ground when the lettuce seed is sown, and 3 ft-high wide-mesh sheep netting, to which rot-proofed hessian has been previously sewn, is hitched to the posts on sheep hooks. The fences are spaced at about 30-yard intervals. The hessian will remain usable for about three years. The operation is expensive and labour-consuming, but again on balance it is considered worth while for potentially valuable early crops.

Conclusion

These, then, are the answers provided by practical farmers with wide and long experience of fenland conditions. They are not the only answers, but

they may well prove to be the most practicable of the many alternatives. But when all is said and done, the final criterion is the economic one. All the various measures tried out all over the fens undoubtedly work, more or less efficiently, but at what cost? Broad Fen Farm is most intensively cropped, without cereals and with the accent upon high-value produce. The kind of system which pays here might not pay elsewhere under a different economy. Be this as it may, this is an enterprising and stimulating attempt to defeat the spring gales which sweep the fenland and cause frustration and dismay among the farming community. As such, it may well point the way ahead to an even greater security for this immensely fertile district.

N. J. Sneesby, B.A.(Hons.) (Reading), M.S.Agric. Econ.(University of California), has been a Research Officer in the Eastern Regional Headquarters of the Agricultural Land Service, at Cambridge, since 1950.

The Ministry's Publications

Since the list published in the July, 1966, issue of *Agriculture* (p. 331) the following publications have been issued.

MAJOR PUBLICATIONS

Plant Pathology Vol. 15 No. 2 (New) 7*s.* 6*d.* (by post 8*s.*)

ADVISORY LEAFLETS

(*Price* 4*d. each—by post* 7*d.*)

No. 30. Currant and Gooseberry Sawflies (Revised)
No. 317. Worms in Poultry (Revised)
No. 533. The Warble Fly (Revised)

MECHANIZATION LEAFLETS

No. 10. Pick-up Balers (New) 1*s.* (by post 1*s.* 3*d.*)

FREE ISSUES

STL No. 26. Circulation Cleaning of Pipeline Milking Plants (Revised)
STL No. 31. Loose Housing of Cows in Cubicle Stalls or Kennels (Revised)
STL No. 55. The Uses of Beans for Stock-feeding (Revised)

The priced publications listed above are obtainable from Government Bookshops (addresses on p. 404*), or through any bookseller. Unpriced items are obtainable only from the Ministry (Publications), Tolcarne Drive, Pinner, Middlesex.*

43. Woodbridge, East Suffolk

G. R. Field

GENTLY undulating and generously wooded, the pleasant scenery of the Woodbridge district surprises those visitors who imagine that all East Anglia is flat and uninteresting. It lies due east of Ipswich, like a diamond, cradled by the North Sea south of Aldeburgh and the Orwell Estuary, with the apex stretching just beyond Framlingham into central East Suffolk. Its rural scene is enhanced by the meandering estuaries of the Alde, Butley River and Deben-Estuaries which were as popular with the invasion-minded Anglo-Saxons, Danes, Normans and smugglers of yesterday, as they are with the pleasure-seeking yachtsmen of today.

Substantial wool churches in many parishes remind us not only of the generosity of merchants in the Middle Ages but also of the past dominance of sheep, which extended well into the 1920s. When a small acreage of sugar beet was first introduced in the early twentieth century, the roots were transported by barge to Holland for processing. The inter-war depression led to the erection of Ipswich beet factory and a rapid rise in the acreage, until sugar beet eventually replaced sheep as the sheet anchor of farming policy. Low cereal prices in the depression also encouraged the spread of dairy herds and winter milking developed on the arable by-products. The agricultural pattern was completed by the yarded bullock and variations on the Norfolk four-course rotation.

Apart from in Ipswich, industry is sparse. Woodbridge itself boasts a canning factory, boat building, pump and shaving brush industries, whilst Felixstowe Dock is awakening to the proximity of the Common Market. Nearby military air bases offer some people alternative employment to agriculture.

Nearly the whole area comprises glacial drift overlying deep chalk. It is neatly partitioned by the A12 into the heavy boulder clay loams of the west and coastal sand lands to the east. Situated in one of the driest corners of England, with an annual rainfall of little over 20 inches, it is small wonder that grazing livestock are scarce and arable cash cropping predominates.

On the fertile chalky boulder clay, farms rarely exceed 300 acres in size. Drainage is the key to fertility, and few fields are not tile-cum-mole drained. Wheat and barley occupy more and more land, with sugar beet the commonest break crop. The traditional rest crop of red clover has declined, but field beans are showing some revival thanks to Simazine. In a few parishes both have been replaced by the more lucrative peas and dwarf beans, for the quick-freezing industry. Given reasonable tilths and not too many wild oats, yields are consistently high. Livestock with no land requirements are favoured,

and whilst the yarded bullocks' quarters are often empty today, few holdings are without a pig unit.

The sandy coastal section is more diversified. Leaving the A12, one crosses very acid heathlands reminiscent of Surrey before entering increasingly more loamy sands nearer the coast. The entire region is fringed with alluvial marshes, patiently converted from saltings by successive enclosures over the centuries. From time to time the North Sea, indignant at man's encroachment, temporarily repossesses these marshes. The last occasion was in 1953, when 10,000 acres were flooded for three weeks. A salt deposit remained, which neutralized production for three years. The stronger sea defences which were constructed after this disaster caused landowners to reconsider the husbandry of the marshes. Traditionally, they provided the summer pasturage for the light land farms in the peninsulas. Higher prices for cereals and grazing cattle, combined with Government grants for drainage and levelling, tempted many to convert these agrostis/white clover pastures into arable production. Powerful pumps replaced the dilapidated outfall sluices, and bulldozers ironed out the surface undulations. Heavy cereal crops have been substituted for second-class grazing and, as under-drainage progresses, profitable rotations are emerging.

Behind the marshes the sand-land farms are large, and 1,000-acre holdings are common. Their unassisted fertility was very lowly rated in the First World War. Large tracts were taken over by the Forestry Commission and planted with conifers. Some landlords of the time even paid their tenants half-a-crown an acre to contend with the combined ravages of rabbits, pigeons, high game populations, wind erosion, acidity and an erratic low rainfall. Such land readily changed hands at £5 per acre.

Alert appreciation of Oldershaw's classical liming experiments at Tunstall in the 1920s, resulted in considerable yield improvements. The area welcomed the mechanization stimulated by the Second World War, and nowadays it is rare to find more than one man per 120 acres. Further improvements came about through generous use of fertilizers and judicial applications of trace elements such as boron, copper and manganese. Myxomatosis made its contribution and eventually only low rainfall stood in the way of consistent farm incomes.

Again, the district revealed its own pioneers, Messrs. W. O. and P. O. Jolly, whose work in agricultural irrigation at the Grange, Kesgrave, has already been recorded in this journal (October, 1951). The technique was so rapidly adopted in the 1950s that light-land farms without irrigation facilities are now in the minority. Marsh dykes and streams are used to full capacity, and spring-fed reservoirs are increasing in numbers.

Barley and sugar beet are the staple crops, but the area is liberally sprinkled with potatoes. On the poorest soils rye is commonly grown for the west country's early bite, though winter wheat and winter oats are slowly gaining ground. The summer scene is often brightened by kale seed crops.

A few pedigree Suffolk sheep flocks have survived to produce ram lambs for crossing purposes whilst Half-breds and Kerry Hills represent the bulk of the commercial sheep population. The other native breed, the Red Poll, has almost dwindled to insignificance in deference to the Friesian.

Modern farming techniques have transformed this coastal belt from a shooting playground for the elite into a highly mechanized arable district, but one that is still rich in sporting amenities.

The Maintenance Survey

W. A. VANDERSTEEN
Agricultural Land Service, Winchester

To carry out a survey of the buildings on the farm to check their state of repair and to see what maintenance work is needed can be a formidable task. But it can be a rewarding one if done systematically. To ensure this, first have a plan drawn to scale showing the layout of the buildings, roads, drains and water supplies. This can conveniently be drawn to a scale of 1/500 or $\frac{1}{32}$ inch to one foot. Carefully plot any old workings, such as wells, for future reference. Knowledge of their presence may well save money and worry when erecting new buildings. Next, decide on the method for carrying out the survey and do not depart from it. Examine each building in turn from all aspects and jot down the matters which require attention, either immediately or in the future, in a notebook which can be referred to at leisure later on. The following notes will serve as a reminder of the defects which should be watched for and recorded during the actual survey.

Look for slipped or missing slates or tiles on roofs. If a lot show signs of damage it might indicate serious trouble and mean getting a contractor in to strip and replace the roof covering. All timbers should be examined and any decayed members noted for future treatment. Cracked asbestos sheets can easily be replaced. Galvanized corrugated sheeting must be inspected for rust or the early onset of it. Small white powdery patches will indicate the start of this. Roof trusses made of steel angles and tees are often badly neglected because they are usually out of reach. It might prove economical to buy, or hire, a portable scaffold to help with the regular survey and maintenance work if there are a lot of these.

Much trouble is caused through defective rainwater installations. Moss and grass growing in the gutters is not uncommon; nor are leaking joints and gutters which slope away from their outlets. A good plan, if an uncomfortable one, is to examine gutters and down pipes when it is raining. Sometimes gutters are fixed too close to the building, so that in a heavy shower the rain from the roof overshoots them. Some gutters are not big enough to cope with the amount of water they have to carry. The most common defect is the cracked or broken rainwater pipe. Consider replacing this with a plastic pipe. The initial extra cost would be quickly covered by the saving resulting from the maintenance-free nature of plastic.

With walls, the fault most frequently found, and one of the most difficult to cure, is undoubtedly damp patches appearing mysteriously on insides of buildings. It could be rising damp due to the absence of a damp-course, which will be an expensive thing to provide. Or it might only be due to soil or rubbish piled against the outside, and a few minutes spent with shovel and barrow could then save pounds on the repair bill. A wall facing the wettest weather can be treated with a transparent silicone waterproofer which should remain effective for some years. Cracked walls must be looked at critically, especially if grain has been recently stored against them. In this case the cracks could indicate structural failure, which might mean expensive renewal.

As a rule, floors do not figure highly in maintenance costs, and any trouble caused is usually accepted as normal wear and tear. Cracked floors can be remedied by hacking up and re-laying the bad portions, but if the cracking is due to faulty construction in the first place, it may be necessary to re-lay all or part of the floor. Wooden floors should be inspected for rot and general decay. Dry rot is most insidious, and any wet, unventilated places should be looked at thoroughly. Any renewal work must be left to experts, remembering that the longer dry rot is left the more it will spread and, therefore, the more costly it will be to put matters right.

All joinery work should be examined for wear and tear. If a door is receiving heavy wear its life can be prolonged by cladding it with metal sheet. If a building is constructed of timber, the framework should receive attention as well as the internal and external cladding.

Concrete buildings should not need much maintenance. Large cracks or broken edges should be examined carefully and if the reinforcement is exposed and rust is present, expert advice should be sought.

The water supply must be inspected to see that all lagging is in place and that all valves and taps are functioning properly.

The overhaul of electrical installations is best left to an expert but obvious faults should be noted. Plugs and cables must have a thorough routine inspection and immediate action taken to rectify any faults.

All drains and fittings should be examined for blockages which can cause flooding, both internally and externally, if not attended to.

To sum up, if a system of maintenance can be worked out dealing with a few buildings each year and painting them every four or five years, the job will gradually be absorbed into the normal running of the farm. Regular maintenance of buildings will certainly save money in the long run and at the same time improve the overall look of the farm. Time devoted to a systematic survey will therefore be time well spent.

Books

Global Impacts of Applied Microbiology. Edited by MORTIMER P. STARR. John Wiley and Sons, 1965. £5 13*s*.

This book reports the proceedings of a co-ordination conference held in Stockholm in 1963 in which 350 specialists in the fields of soil microbiology, medicine, fermentation, phytopathology, immunology, food technology, economics and social administration from 30 countries gave their personal views on the theme 'Microbiological research of Today and its Application to the needs of Tomorrow'.

Micro-organisms are ubiquitous throughout the world and know no national boundaries, being naturally available to all mankind. They can be man's best friend by enriching the soil in which his plants grow, fermenting his wine and beer, providing food in the form of edible fungi and disposing of his waste material. But they can also be his worst enemy by destroying his crops, causing his stored food to rot and producing disease among his domestic animals and his fellow men.

Only in the last seventy-odd years has man applied his mind to using micro-organisms for his own benefit by using certain species of bacteria to enrich the soil, by producing better foods and beverages, vitamins as food supplements and antibiotics for the treatment of disease in animals, plants and human beings, to mention only a few examples. Moulds, yeasts and bacteria are now used to produce enzymes which, on a commercial scale, convert starch into sugar, break down complex proteins, remove hair from hides and help in the preparation of textiles, as well as produce sufficient electrical energy from a bio-chemical fuel cell to operate radio receivers and other devices.

These and many other aspects of microbiological activity are covered in the forty-three papers which, together with a list of recommendations, comprise the volume. The papers are divided among five sections entitled, respectively, Some Philosophies of Applied Microbiology; Interactions of General and Applied Microbiology; Food and Agricultural Microbiology; Industrial and Chemical Microbiology; and Applied Immunology.

No aspect of microbial action seems to have been overlooked and the field covered ranges from theoretical and philosophical considerations to the practical application of microbial processes. However, in all this wealth of scientific knowledge, one point stands out like a beacon and that is the importance of first developing in the minds of those one is trying to help the attitude of acceptance of something that they themselves can effectively utilize. Only when this idea of 'acceptability' is fully appreciated will it be worth while making the methods of science and tools of technology available to those concerned.

C.A.S.

The Economic Demand for Irrigated Acreage. VERNON W. RUTTAN. John Hopkins Press, London: Oxford University Press, 1965. 32*s*.

Professor Ruttan attempts to analyse in this book the economic basis of the demand for irrigated land in order to provide insight into the profitability of public and private investment in major irrigation projects in the United States. In the Western States 90 per cent of all water use is for irrigation, and agriculture is much more dependent on irrigation than in Britain. Nevertheless, similar principles apply in some degree.

An object of the book is to get away from the 'requirements' approach, whereby estimates of water demand are based on the quantity of water required to support some projected level of output regardless of the availability or cost of water. An underlying principle of the author's method is that, if the marginal value product of an input (e.g., irrigation) exceeds the cost of adding additional units of that input to the production process, net returns can be improved by expanding the use of that particular input. This principle is then used to project the future demand for irrigated acreage and water on the assumption that the limit of demand will be reached when the marginal value product equals the capital cost of irrigated land.

Although on a smaller scale, the subject is topical in Britain, especially since the advent of the Water Resources Act 1963

which provides for the comprehensive planning and conservation of water resources, an essential prerequisite of which is the projection of water demand estimates as far ahead as possible. It is interesting to note that estimates of the future demand for irrigation in this country are based on the projection of the past rate of development up to a limit set by the crop acreages which can show an economic return for irrigation after allowing for all costs including the capital or other charges involved in water provision.

The book is written by an economist, but the subject is one which is of interest to anyone concerned with water resource or agricultural planning. The non-economist, however, is likely to find it heavy going unless well acquainted with the terminology, familiarity with which is assumed.

C.N.P.

Extension in Rural Communities. (Oxford Tropical Handbooks). A. H. SAVILE. Oxford University Press, 1965. 21*s*.

Mr. Savile is to be congratulated as probably the first Englishman to write a book about agricultural extension work. Although it is intended for use in the developing countries in the tropics, much of what he has to say is applicable to extension and advisory work in the United Kingdom. Since so much effort towards enumerating and understanding the principles of agricultural extension has been made and published in the United States of America, it is not surprising that many of the ideas put forward in this book come directly from the literature of that country.

In the communication of technical information to farmers one can perceive a wide range of institution. Towards one extreme there is a consultant in some speciality, like plant pathology or soil science, and towards the other there is the community worker who seeks to develop many things besides farming. The motives vary from personal gain, to the achievement of national goals through government policy, to the improved conditions and happiness of rural people. Along this continuum are to be found advisory work and extension work; differences between them appear to be ones of degree in their motives and their methods. The author attempts to differentiate sharply between them in his introductory chapter, whereas emphasis on the similarity of objectives might perhaps have been useful. He follows this with four pages entitled 'The Basic Principles of Extension' in which such admirable brevity is rewarded by a clear statement of what should be the foundation of extension and advisory work the world over.

The help from a number of people, acknowledged in the Introduction, probably explains a curiously uneven treatment of the subject. In several chapters practical, down-to-earth hints are given about successful practices in planning and carrying out extension. But there are times when one suspects that difficulties are not appreciated by Mr. Savile because he has overcome them by years of experience. A particular example of this occurs in an all-too-brief discussion of the collection of information by surveys. This is an activity in which the inexperienced can ask the wrong questions, obtain inaccurate answers, and draw unsound conclusions. Africa is littered with schemes started on such a foundation of shifting sands, doomed to failure before they began.

Of less interest, perhaps, to extension workers in the United Kingdom are two valuable chapters on co-operative societies and the training of junior extension workers. It seems to me that developing countries urgently need technicians who talk and think like the villagers who need their help, and who, above all, will forsake the comfort of an office chair for the dust and dirt of the bush. If there is a theme to this book it is the need for extension workers in the tropics to get out to see and deal with people and things as they really are.

H.T.E.S.

Feeding, Digestion and Assimilation in Animals. J. B. JENNINGS. Pergamon Press, 1965. 21*s*.

Agriculturists are a narrow-minded species, for their concepts of animals and animal nutrition are largely confined to farm livestock, including poultry. They are apt to forget that, to the zoologist, the term 'animal' embraces the invertebrates and the vertebrates (or should we say the chordates?) from the protozoa to mammalia, including man. This book, written by a zoologist primarily for zoological students, essentially comprises a survey of feeding mechanisms, ingestion, digestion and assimilation of food by animals in the wider zoological sense, an account of their various alimentary systems,

and finally a broader discussion of the processes of digestion and absorption in selected animal types. Only in discussions of the nature of 'food', again in its widest sense, and of the essential components of food, does the book range over ground more familiar to the agriculturist, but so much has been condensed into its modest 220 or so pages that the treatment of these topics is necessarily brief, cursory and, in places, inexact.

The approach to the subject is, naturally, more zoological than biochemical. The extreme compression of the nutritional aspects leaves the reader often misinformed. For example, the signs (*D*) and (*L*) applied to sugar isomers nowadays refer to their structural configuration not to the directions in which they rotate the plane of polarized light, and such usage here leaves the implication that fructose is a dextrorotatory compound. Again, terms like 'lactoflavin' and 'inoxitol' (*sic*), repeated in both text and index, could well disappear or be corrected, and few agricultural students are taught today (we hope!) that simple sugars are amongst the break-down products of digestion of cellulose in the reticulo-rumen.

The appeal of the book must of necessity be primarily to the zoologist, and the author has assembled much useful information and presented it in a readable manner. It is often refreshing and always salutary to those engaged in applied agricultural science to see how the pure scientist looks at subjects that the applied scientist too often exclusively regards as his own. In this connexion it is well to be reminded that fundamentally the terms 'animal' and 'animal nutrition' have a far wider connotation than is normally ascribed to them. That is exactly what this book does.

A.E.

Portrait of Dorset. RALPH WIGHTMAN. Robert Hale, 1965. 21*s*.

Portrait of Dorset is a delight to the reader. It is very easy to read, and from the beginning one has the feeling that this work was a labour of love. Much of the information has undoubtedly been derived from a wide variety of sources; but throughout the whole volume of nearly 200 pages, packed with information, there is a constant reminder that the writer is drawing on the experience of a lifetime engaged in agricultural activities in the Dorset countryside. Ralph Wightman is one of 'nature's gentlemen'. He is a keen observer of natural phenomena, with a poetic feeling for the use of words and a rather fundamental approach to life.

The central theme of the book is based on the geology of the county. This may make it sound rather dreary and uninteresting. In fact, he has spun a delightful pattern and carefully interwoven a sequence of ideas to form a complete and beautiful picture of one of our most charming counties. Introducing this theme, he writes on the first page, 'A geological map shows all the rocks of Eastern England coming down into Dorset like the ribs of an open fan. The result is a miniature of almost every kind of scenery'.

This is no ordinary county guide, which is so often a sequence of rather impersonal disjointed slices of information, but a comprehensive and personally coloured description of the varied countryside of Dorset. Reasons are given for the occurrence and type of the villages and towns that exist in connection with particular geological formations. There are numerous accounts of agricultural pursuits and the developments that have taken place in farming and many other rural activities over the years.

For those familiar with the county, the book provides a haven of information about places they may know well and a stimulus to see others they have so far neglected. Those who do not know Dorset will find in this book a charmingly simple and fairly systematic account of an unspoiled jewel of English counties.

L.J.McH.

The Rhododendron and Camellia Year Book 1966. Royal Horticultural Society. 15*s*. (by post 17*s*.).

Some might quibble at associating the word 'exciting' with rhododendrons and camellias, but this year book fully justifies it. This is all the more surprising after reading Sir Giles Loder's foreword, which points out how thoroughly the nineteen previous issues have covered the field of interest. But all the world's rhododendrons have still to be gathered in, and here we have a graphic account of a collecting expedition in north-east India. Another arresting article describes collecting at high altitudes in New Guinea.

Werrington Park, a treasure house of early rhododendrons, is one of the gardens reviewed and the inclusion of interesting plants associated with rhododendrons lift this and the account of Arduine above the level of a mere catalogue.

Exciting as rhododendrons are, they convey an atmosphere of being strangers and sojourners to be visited and revered; they cannot be tucked cosily into homely gardens. Camellias, their frequent associates, seem much more domesticated though still aristocratic, and it is appropriate that the most useful contribution in the smaller section devoted to them is a practical one giving the amateur lucid directions for propagation from cuttings. Another interesting article describes old camellias planted by early French settlers in New Zealand and recent successes there, such as the wonderful development of the Kunming *reticulatas*.

Descriptions of rhododendron and camellia shows bring back memories for those fortunate enough to have attended them and indicate the very high standards now reached. Records of awards and registrations form essential data for professional workers.

Illustrations are lavish—68 in all. Although a few hardly reach the quality expected today or have no reference to the text, many are outstanding, in particular two colour plates of *Rhododendron schlippenbachii* 'Prince Charming' and *Camellia reticulata* 'Shot Silk'. There are also excellent black-and-white photographs taken in the gardens described and at various shows.

K.H.J.

Safety and Health in Agricultural Work. International Labour Office, 1965. 12*s*.

Produced by the International Labour Office, this book has been completed on the advice of experts in farm safety of many countries. It is clear that detailed care has gone into its preparation. The fact that it runs to 125 pages reflects the infinite variety of farm work and consequently the scope of the hazards facing the farmer and farm worker in the course of his daily work. The book contains a wealth of good safety advice expressed in the simplest terms, and the chapters on farm machinery and farm buildings could be studied with advantage by our machinery manufacturers and those who erect buildings.

Much of the advice contained in the code has been written into regulations made in Great Britain under our Agriculture (Safety, Health and Welfare Provisions) Act 1956 and The Agriculture Poisonous Substances Act 1952, and much more follows the lines of safety advice which the Ministry gives in various ways. The code emphasizes the accepted principle that, whilst it is the duty of the employer to provide the means of safe working, there is a corresponding duty laid on workers to make proper use of the safeguards provided and also to observe rules of safe conduct.

It is of interest to note that the code recommends that tractors should be fitted with cabs or frames strong enough to protect the driver if his tractor overturns. Proposals for regulations on these lines have recently been circulated to interested organizations in Great Britain.

The section on toxic chemicals follows closely the lines of our own regulations and advice, but more emphasis could have been put on safe storage of full or part-used containers, and on the importance of cleansing empty containers. A clean pesticide container may be a nuisance but one that contains residual toxic chemical is a positive danger.

Mention is made of overhead electricity lines in relation to the siting of electric fences, but there might well have been a paragraph warning of the more general dangers of overhead power lines and the need to build ricks well away from them. A similar warning could have drawn attention to the danger of using high equipment such as ladders, elevators, etc., in the vicinity of power lines. On firearms the code says that loaded guns should not be carried on a vehicle if they are likely to cause danger. In this country we can go further and say that a loaded gun should *not* be carried on a tractor or farm machine.

No code of this nature can be comprehensive, but this book is first-class material which should be read by as many people as possible who are concerned directly or indirectly with the agricultural industry. Where the relevant sections of the code are put into practice lives will be saved and human suffering prevented.

G.S.W.

Rural Science Course Book I. J. A. SHORNEY. Thomas Nelson and Sons, 1965. 8*s*. 6*d*.

Rural science as an active study is taught in many rural secondary schools throughout the country. This subject—or rather group of interests—permits many types of indi-

vidual approach, based on local conditions, school facilities and the knowledge of the teacher. Much of this work is done on an *ad hoc* basis, governed by these very practical considerations.

With the coming of the new Certificate of Secondary Education, something of a backbone is being put into these courses. Whatever the educational merits may be, it does help in planning schemes of work and providing a definite aim. Mr. Shorney's book is designed to cover half the work needed for a C.S.E. course in rural science at a secondary school. A second book will go further into the study of plants, crops and animals.

This first volume covers the soil and the way it is handled, plants, plant foods and plant systems. It is essentially a simple book, aimed at the school child, who may use it as a text-book. The basic principles are defined clearly and simply, following a fairly well-worn track. Although some of these basic principles are covered and explained well, this type of work cannot be regarded as an agricultural text-book. It gives a tinge of farming knowledge to a course which covers simple science and rural general knowledge.

The book is attractively designed and set out. The writing is clear, although some of the paragraphs run on at length. The illustrations are well drawn, distinct and mostly instructive; one or two try to do too much and may in fact confuse the reader (pp. 13, 18, 38). Each section of the book ends with useful lists of jobs to do, and investigations to carry out. An appendix contains 60 questions on the work covered, and there is a functional index. The short section on crop rotations tends to give the impression that the Norfolk Four Course is still widely used; there must be many serious-minded students who suffer disappointment when they fail to find it in practice.

G.B.

Source Book for Agricultural Education. Moray House College of Education: Publication No. 4. ROBERT T. WRIGHT. Oliver and Boyd, 1966. 5*s*.

The volume of new scientific knowledge in agriculture is reaching flood-tide proportions; indeed, it is estimated to double every twelve years. Teachers and students, therefore, face the ever more difficult problem of keeping abreast of the findings of recent research and development in their own particular fields of interest. This is no easy task in agriculture, an industry of very many ramifications. It is, therefore, most salutary for a Source Book for Agricultural Education (including horticulture and forestry) to be published, and undoubtedly this work of reference will be greatly appreciated by all whose work necessitates delving into the problems of farming today or who face the problem of disseminating knowledge to an ever-widening circle of students.

The book opens with a very useful general survey of Government Services and a clear exposition of the general structure of the advisory, research and educational facilities. An extremely revealing chapter on H.M.S.O. will provide many teachers with invaluable additional information. For instance, I discovered a number of publications of interest which I did not realize existed. Another chapter provides a list of addresses where information facilities and publications can be obtained. A very full and detailed chapter deals with the Government Services, and it is clearly evident how all-embracing these are.

Other chapters deal with the press, films and visual aids, together with details of the vast commercial sources available. A quite novel, but nonetheless valuable feature, is a chapter devoted to the supplies of equipment for schools and colleges. The book list provided forms a useful framework on which more specialist knowledge can be built, and finally, addresses are given for centres of full-time agricultural education, County Education Authorities, and Regional Advisory Councils. To aid easy reference, a workmanlike index is provided.

Without question, this new addition to our literature is a 'must' for all teachers, students and others engaged in the educational enterprise. But I would go much further and say that every youngster at school with interest in the land would benefit by being given a copy. At five shillings it can only be a sound investment. All careers masters and youth employment officers will need to have their own copies. In addition, hundreds of practising farmers would find this slim volume of inestimable use to them in their daily work.

The author is to be congratulated on his thoroughness in preparing the book, and the sponsors, the Governors of Moray House College of Education, on their wisdom in realizing the need for such a source book, and for bringing about its publication.

H.I.M.

Dairy Farming Today

THE B.B.C. is to launch a new series of agricultural education programmes devoted to dairy farming and aimed specifically at the man who works in the cowshed or parlour. It will start on Thursday, 6th October, at 12.30, and continue at weekly intervals until 15th December.

The series will deal with practical management problems and the final programme is to be devoted to questions sent in by cowmen. Three veterinary surgeons will take part, together with Professor Eric Lamming of Nottingham University, Derek Barber, County Agricultural Adviser for Gloucestershire, Philip Bolam, who holds the same position in Norfolk, Dr. Kevin O'Connor of the Milk Marketing Board, and Kenneth Russell, Principal of the Shuttleworth Agricultural College. The series will be introduced by Bill Wheeler, Vice-Principal of the Norfolk School of Agriculture. There will be visits on film to dairy farms in various parts of England and to the West of Scotland Agricultural College at Auchincruive.

A booklet is being produced to support the programmes, containing articles by the contributors, and this will be on sale well before the series starts. The success of this first venture by the B.B.C. into agricultural education will depend entirely on the support from farmers and cowmen. It is of vital importance that the programmes are a success, and it is hoped that the industry will take advantage of the advice that will be given by leading experts in 'Dairy Farming Today.'

Books Received

Documentation in Agriculture and Food, No. 77. Advisory Work in Farm Management. Organisation for Economic Co-operation and Development, 1966. 15*s.*

An Economic Study of Potatoes: 1964. E. Dawson. Farmers' Report No. 169, Department of Agriculture, Economics Section, University of Leeds, 1966. 4*s.*

ACKNOWLEDGMENT OF PHOTOGRAPHS

We gratefully acknowledge permission to use the following photographs:

P. 351 John Topham Ltd. Pp. 352 and 368 *Farmer's Weekly*. Pp. 357 and 359 National Institute of Agricultural Engineering. P. 365 Plant Protection Ltd. P. 371 Picturepoint, London. P. 391 J. E. Gittens. Pp. 392 and 393 Kenneth I. Oldroyd.

AGRICULTURE

Price 1s. 3d. net monthly (by post 1s. 9d.).

Subscription Rates, Home and Overseas: £1 1s. 0d. per annum (including postage).

Subscriptions may start with any issue and should be sent to:

HER MAJESTY'S STATIONERY OFFICE

49 High Holborn, London W.C.1
13a Castle Street, Edinburgh 2
Brazennose Street, Manchester 2
35 Smallbrook, Ringway, Birmingham 5
423 Oxford Street, London W.1
109 St. Mary Street, Cardiff
50 Fairfax Street, Bristol 1
80 Chichester Street, Belfast

Single copies can be purchased from any of the above-mentioned addresses or through a bookseller.

Printed in England for Her Majesty's Stationery Office
by Hull Printers Limited, Willerby, Hull, Yorks.

(K107) 72-1-66-8

OFFICIAL APPOINTMENTS

PLANTING DIRECTOR (Oil Palm)

Federal Land Development Authority—Malaysia

Duties: To liase closely with the Director, Technical Operations Department of the F.L.D.A. in the planning, guidance and supervision of the Oil Palm Programme consisting of planting 50,000 to 100,000 acres of oil palm over a five year period.

Qualifications: Candidates must have had 15 to 20 years' administrative and practical experience in oil palm planting operations and a thorough knowledge of field planting, maintenance and harvesting. Some experience with oil palm processing methods is desirable. Possession of an Agricultural degree would be an advantage.

Emoluments: Basic salary in the region of £2,800 a year, subject to British Income Tax, plus a variable non-taxable foreign service allowance, payable at present at the rates of £445 (single), £950 (married unaccompanied) or £1,395 (married accompanied) a year. Three year contract. Generous leave. Free passages. Education allowances.

Applicants, who should be nationals of the United Kingdom or the Republic of Ireland, should write for further details, giving full name and brief particulars of qualifications and experience, quoting RC 213/106/08 to:—

Appointments Officer,
Room 301,
MINISTRY OF OVERSEAS DEVELOPMENT,
Eland House,
Stag Place,
London, S.W.1.

CHIEF AGRICULTURAL OFFICER

MID-WESTERN NIGERIA

Required to administer the Agricultural Service, Division of the Ministry of Agriculture and Natural Resources in Mid-Western Nigeria and to be chief professional adviser on all agricultural matters.

Candidates should be trained agriculturists with a degree in pure science, agriculture or horticulture, plus considerable practical experience in tropical agriculture.

Salary range £2,500 to £3,000 a year, subject to British income tax, plus a variable tax free overseas allowance of £730 (single) or £1,330 (married unaccompanied) or £1,535 (married accompanied) a year.

Passages and accommodation provided. Education allowances. Free medical and dental treatment.

Contract appointment for one tour of two years in the first instance.

Candidates, who should be nationals of the United Kingdom or the Republic of Ireland, should write giving full name and brief particulars of qualifications and experience, quoting RC 213/200/01 to:

Appointments Officer,
Room 301,
MINISTRY OF OVERSEAS DEVELOPMENT,
Eland House, Stag Place,
London, S.W.1.

DIRECTOR OF AGRICULTURE

BRUNEI

Duties: To administer the Agricultural Department and formulate and implement schemes of policy for agricultural development in Brunei.

Qualifications: Candidates who should be between 35 and 45 years of age must hold a degree in Agriculture or an honours degree in any of the Natural Sciences plus two years post-graduate experience in general agriculture at a University or recognised institution. Ten years' experience in tropical agriculture is essential. Preference will be given to Malay-speaking candidates.

Salary: £3,318 p.a. plus a gratuity of 12½% of basic salary. Contract appointment for two years. Passages and quarters provided. Education allowances. Generous leave. No local income tax.

Applicants should write for further details, giving full name and brief particulars of qualifications and experience quoting RC 213/28/01 to:

Appointments Officer,
Room 301,
MINISTRY OF OVERSEAS DEVELOPMENT,
Eland House, Stag Place,
London, S.W.1.

OFFICIAL APPOINTMENT

CHIEF ANIMAL HUSBANDRY OFFICER

ZAMBIA

Required to advise the Deputy Director of Agriculture (Extension) on all matters related to animal production, to provide specialist advice and training to staff and other Departments and to administer certain regulatory aspects related to livestock production.

Candidates must possess a degree in agriculture or animal husbandry and at least ten years' experience in this specialised field.

Salary £2,770 a year plus 25% terminal gratuity. A supplement of £300 a year is also payable direct to the officer's bank account in the United Kingdom or the Republic of Ireland. Passages provided. Education allowances. Government quarters. 3 years contract. Generous leave. Candidates who must be nationals of the United Kingdom or the Republic of Ireland, should write for further details, giving full name and brief particulars of qualifications and experience, quoting RC/213/132/032 to:

Appointments Officer,
Room 301,
MINISTRY OF OVERSEAS DEVELOPMENT,
Eland House,
Stag Place,
Victoria,
London, S.W.1.

EVENSTORM IRRIGATION—

★ Rotary sprinklers ★ Rain guns
★ Organic irrigation (effluent disposal)
★ Portable aluminium mains
★ Glasshouse and outdoor spray lines

EVENTHERM SPACE HEATERS—

Portable, oil-fired, up to 200,000 B.T.Us. Thermostatically controllable for frost protection in potato stores, etc.

Details from EVENPRODUCTS LTD., Evesham, Worcs. Tel. Evesham 6633/4.

STAFF VACANCIES

Agricultural colleges, Institutes and University departments
Commercial undertakings, etc.

Attention!

For the best results advertise your staff vacancies in the Journal of the Ministry of Agriculture

Agriculture

Full details from the Advertisement Representatives:
COWLISHAW & LAWRENCE (Advtg) LTD
16 Farringdon Street, London, E.C.4
(Smallest bookable space ¼th p.)

Domestic Preservation of Fruit and Vegetables

The eleventh edition of this illustrated bulletin contains a number of recipes which have been amended and brought up-to-date. A short account of the principles of preservation and the choice of methods which may be used is followed by precise descriptions of the different practical processes. The bulletin has long been accepted as a manual for the teacher and student of domestic science and it has proved an invaluable help to the housewife. **6s.** (6s. 8d.)

Plant Pathology

A quarterly publication presenting original contributions on plant diseases, plant pests, rodent and bird damage, nutritional and physiological disorders of interest to the mycologist, entomologist, helminthologist, soil or nutrition chemist, plant physiologist and meteorologist.
7s. 6d. (7s. 11d.); Annual subscription 31s. 8d. including postage

N.A.A.S. Quarterly Review

The Journal of the National Agricultural Advisory Service.
A technical publication for officers of the National Agricultural Advisory Service and the more technically-minded farmer and horticulturist. It contains articles on technical and scientific aspects of farming, and abstracts of recently published material.
2s. (2s. 5d.); Annual Subscription 9s. 4d. including postage

Prices in brackets include postage

Free lists of titles (state subject/s) are available from Her Majesty's Stationery Office, P6A, Atlantic House, Holborn Viaduct, London, E.C.1

HMSO

Government publications can be purchased from the Government Bookshops in London (post orders to P.O Box 569, S.E.1), Edinburgh, Cardiff, Belfast, Manchester, and Bristol, or through any bookseller